



Workshop Manual Touareg 2003 ➤

5-cylinder diesel engine

Engine ID	BAC	BLK	BPD	BPE					
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Edition 11.2011



List of Workshop Manual Repair Groups

Repair Group

- 00 - Technical data
- 10 - Removing and installing engine
- 13 - Crankshaft group
- 15 - Cylinder head, valve gear
- 17 - Lubrication
- 19 - Cooling
- 20 - Fuel supply system
- 21 - Turbocharging/supercharging
- 23 - Mixture preparation - injection
- 26 - Exhaust system
- 28 - Glow plug system

Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.



Contents

00 - Technical data	1
1 Technical data	1
1.1 Engine number	1
1.2 Engine data	1
2 Safety instructions	2
2.1 Safety precautions when working on fuel supply system	2
2.2 Safety precautions for when using test and measuring equipment during a road test	3
2.3 Safety precautions when working on cooling system	3
3 General repair notes	4
3.1 Rules for cleanliness	4
3.2 Foreign objects in engine	4
10 - Removing and installing engine	5
1 Removing and installing engine	5
1.1 Removing engine	5
1.2 Removing engine from scissor-type assembly platform	14
1.3 Securing engine to assembly stand	15
1.4 Additional information and assembly work for vehicles with air conditioner	16
1.5 Installing engine	17
2 Assembly mountings	18
2.1 Assembly overview - engine mountings	18
2.2 Specified torques - Assembly mountings	18
13 - Crankshaft group	19
1 Dismantling and assembling engine	19
1.1 Dismantling and assembling engine, parts I-III	19
1.2 Removing and installing crankshaft	24
1.3 Removing and installing drive plate	25
1.4 Crankshaft bearing cap identification	26
1.5 Crankshaft dimensions	27
1.6 Renewing crankshaft oil seal - engine timing end	27
1.7 Renewing alternator shaft oil seal	28
2 Dismantling and assembling pistons and conrods	30
2.1 Assembly overview - pistons and conrods	30
2.2 Separating new conrods	31
2.3 Installation position and allocation of piston to cylinder	32
2.4 Checking piston ring gap	32
2.5 Checking ring-to-groove clearance	32
2.6 Checking cylinder bores	33
2.7 Piston and cylinder dimensions	33
15 - Cylinder head, valve gear	34
1 Overview - cylinder head	34
1.1 Assembly overview - cylinder head	34
1.2 Renewing pipe connection for coolant	36
1.3 Removing and installing camshaft drive gear	37
1.4 Setting engine to TDC No. 1 cylinder	41
1.5 Removing and installing cylinder head	42
1.6 Checking compression	45
2 Repairing valve gear	47
2.1 Assembly overview - valve gear	47
2.2 Reworking valve seats	51



2.3	Checking valve guides	53
2.4	Renewing valve stem seals	53
2.5	Removing and installing camshaft	55
17	- Lubrication	57
1	Engine oil	57
1.1	Oil capacities	57
1.2	Checking engine oil level	57
2	Parts of lubrication system	58
2.1	Assembly overview - oil pump, sump	58
2.2	Assembly overview - oil filter housing	59
2.3	Removing and installing oil sump	62
2.4	Checking oil pressure and oil pressure switch	65
19	- Cooling	67
1	Removing and installing parts of cooling system	67
1.1	Parts of cooling system, body side	68
1.2	Assembly overview - radiator fan	69
1.3	Removing and installing fan support	69
1.4	Parts of cooling system, engine side	70
1.5	Coolant hose schematic diagram	72
1.6	Draining and filling coolant	72
1.7	Removing and installing radiator	75
1.8	Removing and installing coolant pump	77
1.9	Checking oil cooler for leaks	83
20	- Fuel supply system	85
1	Removing and installing parts of fuel supply system	85
1.1	Rules for cleanliness	85
1.2	Safety precautions when working on fuel supply system	86
1.3	Assembly overview - fuel tank with attachments (► model year 08)	87
1.4	Assembly overview - fuel tank with attachments (model year 08 ►)	88
1.5	Assembly overview - fuel filter with fuel cooler	90
1.6	Emptying fuel tank	91
1.7	Removing and installing fuel pump unit, fuel gauge sender and suction jet pumps (for vehicles ► model year 08)	95
1.8	Removing and installing fuel pump unit, fuel gauge sender and suction jet pumps (for vehicles model year 08 ►)	97
1.9	Removing and installing fuel tank with attached components	100
1.10	Checking fuel pumps	102
1.11	Checking tandem pump	104
1.12	Removing and installing tandem pump	107
1.13	Assembly overview - accelerator mechanism	109
21	- Turbocharging/supercharging	110
1	Charge air system with turbocharger	110
1.1	Rules for cleanliness	110
1.2	Turbocharger with attachments for engine codes BAC and BLK	110
1.3	Removing and installing turbocharger for engine codes BAC and BLK	112
1.4	Turbocharger with attachments (engine codes BPD and BPE)	114
1.5	Removing and installing turbocharger (engine codes BPD and BPE)	116
1.6	Removing and installing parts of charge air cooling	120
1.7	Checking charge air system for leaks	121
1.8	Hose connections	123
1.9	Vacuum hose schematic diagram	125
23	- Mixture preparation - injection	127



1	Repairing diesel direct injection system	127
1.1	Safety precautions	127
1.2	Rules for cleanliness	128
1.3	Removing and installing unit injector	128
1.4	Assembly overview - unit injector	132
1.5	Removing and installing O-rings for unit injector	133
1.6	Assembly overview - intake manifold and fuel rail	135
1.7	Repairing intake manifold flap	136
1.8	Dismantling and assembling air filter	138
2	Engine control unit	139
2.1	Reading and deleting engine control unit event memory	139
2.2	Removing and installing engine control unit J623	140
2.3	Removing and installing anti-theft engine control unit J623	140
26 -	Exhaust system	144
1	Exhaust system	144
1.1	Assembly overview - front exhaust pipe with catalytic converters	145
1.2	Assembly overview - front exhaust pipe with particulate filter	146
1.3	Removing and installing particulate filter	147
1.4	Assembly overview - exhaust manifold (engine codes BPD, BPE)	148
1.5	Removing and installing exhaust manifold (engine codes BPD, BPE)	150
1.6	Silencer with mountings	153
2	Exhaust gas recirculation system	154
2.1	Assembly overview - exhaust gas recirculation	155
2.2	Checking exhaust gas recirculation valve (mechanical)	158
28 -	Glow plug system	160
1	Glow plug system	160
1.1	Characteristics of glow plugs	160
1.2	Checking metal glow plugs	160
1.3	Removing, installing and checking ceramic glow pin plugs	162





00 – Technical data

1 Technical data

⇒ „1.1 Engine number“, page 1

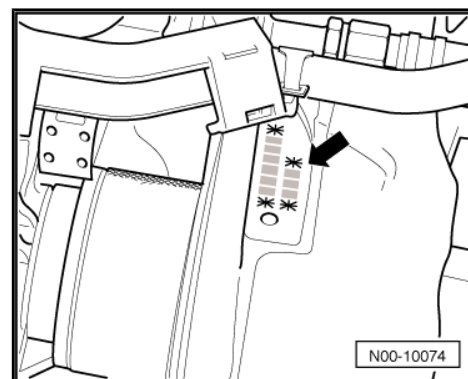
⇒ „1.2 Engine data“, page 1

1.1 Engine number

The engine number („engine code“ and „serial number“) can be found on the joint between engine and gearbox.

Additionally there is a sticker on the front of the cylinder head with „Engine code“ and „Serial number“.

The engine code is also included on the vehicle data sticker.



1.2 Engine data

Edition 11.20011 Version 21.0

Engine code	BAC	BLK	BPD	BPE
Manufactured	03.03 ►	08.03 ►	11.05 ►	11.05 ►
Emissions fulfil	EU3 standard	EU3 standard	EU4 standard	EU4 standard
Capacity l	2.5	2.5	2.5	2.5
Output kW at rpm	128/3500	120/3500	120/3500	128/3500
Torque Nm at rpm	400/2000... 2300	400/2000... 2300	400/2000	400/2000
Bore Ø mm	81.0	81.0	81.0	81.0
Stroke mm	95.5	95.5	95.5	95.5
Compression ratio	18.0	18.0	19.5	19.5
Fuel according to	DIN EN 590	DIN EN 590	DIN EN 590	DIN EN 590
Firing order	1-2-4-5-3	1-2-4-5-3	1-2-4-5-3	1-2-4-5-3
Catalytic converter	yes	yes	yes	yes
Exhaust gas recirculation	yes	yes	yes	yes
Turbocharging/supercharging	yes	yes	yes	yes
Particulate filter	no	no	yes	yes
Charge air cooling	yes	yes	yes	yes

Volkswagen Technical Site: <http://vwts.ru> <http://vwts.info>



2 Safety instructions

⇒ „2.1 Safety precautions when working on fuel supply system“,
page 2

⇒ „2.2 Safety precautions for when using test and measuring
equipment during a road test“, page 3

⇒ „2.3 Safety precautions when working on cooling system“, page
3

2.1 Safety precautions when working on fuel supply system



WARNING

Risk of injury due to highly-pressurised fuel.

- ◆ *For safety reasons, the fuse must be removed from the fuel pump control unit -J538- before the fuel system is opened if the battery has not been disconnected. Otherwise the fuel pump will be activated by the driver door contact switch.*
- ◆ *Wrap a clean cloth around the connection before opening the fuel system. Then release pressure by carefully loosening the connection.*
- ◆ *Wear protective gloves.*
- ◆ *Wear eye protection.*

Danger of burning from very hot fuel.

- ◆ *In extreme cases, the temperature of the fuel or the fuel lines can reach 100 °C after the engine is switched off. Allow the fuel to cool down before disconnecting the lines - danger of scalding.*
- ◆ *Wear protective gloves.*
- ◆ *Wear eye protection.*

To prevent injuries to persons and destruction of the injection and glow plug system, the following must be noted:

- ◆ Always switch off the ignition before connecting or disconnecting electrical wiring of injection and glow plug system or connecting/disconnecting tester cables.
- ◆ Wash the engine only with the ignition switched off.
- ◆ Entries have been stored in the event memory of the engine control unit if the engine was started after electrical connectors had been disconnected: Read event memory in vehicle self-diagnosis ⇒ Vehicle diagnosis tester .



Caution

- ◆ *Observe required procedures when disconnecting battery ⇒ Electrical system; Rep. gr. 27 ; battery; Disconnecting and reconnecting battery.*

- Disconnect battery ⇒ Electrical system; Rep. gr. 27 .



2.2 Safety precautions for when using test and measuring equipment during a road test

Note the following if testers and measuring instruments have to be used during a road test:

- ◆ Test and measuring instruments must always be secured to the rear seat and operated by a second person from this location.
- ◆ If test and measuring instruments are operated from front passenger seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is triggered.

2.3 Safety precautions when working on cooling system



WARNING

Hot steam/hot coolant can escape - risk of scalding.

- ◆ *The cooling system is under pressure when the engine is hot.*
- ◆ *Cover filler cap on expansion tank with a cloth and open carefully to release pressure.*

Danger of injury; the radiator fans can run at any time.

- ◆ *Disconnect electrical connectors before starting work in the area of the radiator cowl.*



Caution

Danger of overheating due to incorrectly fitted cap.

- ◆ *Tighten cap of coolant expansion tank until it engages.*



3 General repair notes

⇒ „3.1 Rules for cleanliness“, page 4

⇒ „3.2 Foreign objects in engine“, page 4

3.1 Rules for cleanliness

When working on fuel supply and injection system, pay careful attention to the following rules for cleanliness:

- ◆ Before disconnecting, thoroughly clean all connections and adjacent areas e.g. with brake cleaner.
- ◆ Place removed parts on a clean surface and cover. Use only lint-free cloths.
- ◆ Carefully cover opened components and connections or seal if repairs cannot be carried out immediately.
- ◆ Install clean components only. Do not remove replacement parts from packing until immediately before installing. Do not use parts that have not been stored in their packing (e.g. in tool boxes etc.).
- ◆ When the system is open: Do not work with compressed air. Do not move vehicle.
- ◆ Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

3.2 Foreign objects in engine



Note

If large quantities of swarf or metal particles (caused, for example, by partial seizure of the crankshaft or conrod bearings) are found in the engine oil when performing repairs, clean the oil passages thoroughly and renew the engine oil cooler in order to prevent subsequent damage.



10 – Removing and installing engine

1 Removing and installing engine

⇒ „1.1 Removing engine“, page 5

⇒ „1.2 Removing engine from scissor-type assembly platform“, page 14

⇒ „1.3 Securing engine to assembly stand“, page 15

⇒ „1.4 Additional information and assembly work for vehicles with air conditioner“, page 16

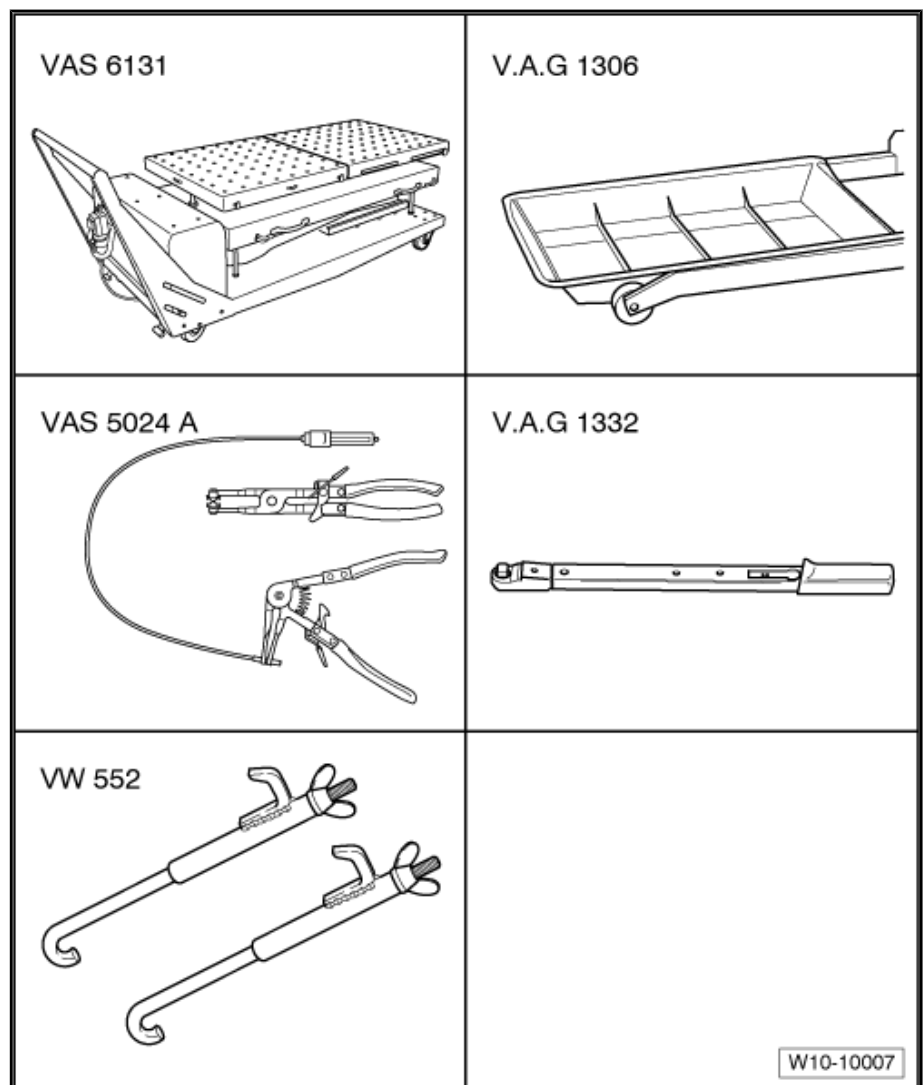
⇒ „1.5 Installing engine“, page 17

⇒ „2.2 Specified torques - Assembly mountings“, page 18

1.1 Removing engine

The engine is removed downwards with gearbox.

- ◆ Scissor-type assembly platform -VAS 6131-
- ◆ Drip tray -V.A.G 1306- or drip tray for workshop hoist -VAS 6208-
- ◆ Spring-type clip pliers -VAS 5024 A-
- ◆ Torque wrench -V.A.G 1332- (40...200 Nm)
- ◆ spring compressor -VW 552-



Not illustrated:

- ◆ Basic set for Touareg -VAS 6131/6-



- ◆ Engine and gearbox support -T10220- or engine and gearbox support -T10342-
- ◆ Engine bracket -T10224-
- ◆ Container for removed parts -V.A.G 1698-
- ◆ Cable ties



WARNING

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- ◆ *All the various lines, e.g. for activated charcoal filter system, electrical wiring as well as*
- ◆ *Fuel lines*
- ◆ *Hydraulic lines*
- ◆ *Coolant and refrigerant lines*
- ◆ *Lines for brake fluid*
- ◆ *and vacuum lines*
- ◆ *must be routed in their original positions.*
- ◆ *Ensure that there is sufficient clearance to all moving or hot components.*

- First check whether a coded radio is fitted. If so, obtain anti-theft coding.



Note

- ◆ *Leave ignition key in ignition lock to prevent steering lock from engaging.*
- ◆ *It is advisable to remove the front wheels before beginning engine removal. The vehicle can then be lowered on hoist until the brake disc splash plates are just above the floor. This provides a more ergonomic working position regarding accessibility of engine compartment components.*
- ◆ *Some components cannot be removed, or removed only with difficulty, with the engine installed. Therefore, you should determine all defective components before removing engine and renew them while engine is removed.*
- ◆ *To prevent damage to removed components, place them in the container for removed parts -V.A.G 1698-.*
- All cable ties which are opened or cut through when engine is removed must be replaced in the same position when engine is installed.
- Disconnect batteries ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .

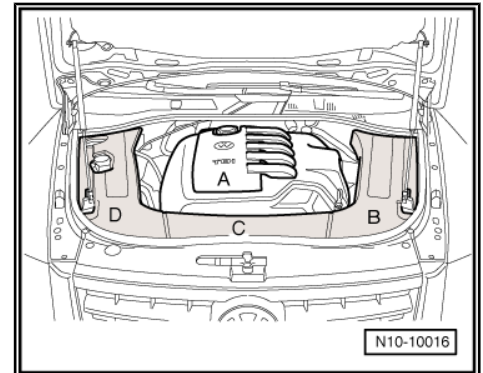
Vehicles with manual gearbox

- Remove selector mechanism from centre console ⇒ Rep. gr. 34 ; Selector mechanism; Assembly overview - selector mechanism .
- Then place selector mechanism on gearbox.

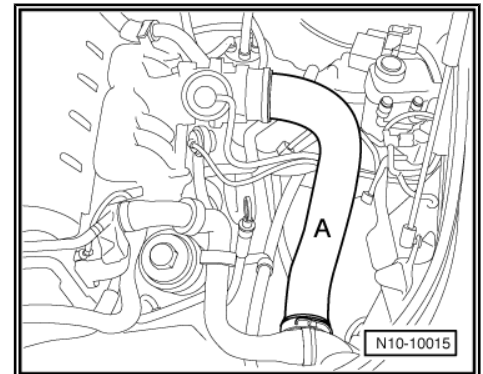


Continuation for all vehicles

- Remove engine cover -A- and engine compartment covers -B-, -C- and -D-, if fitted.



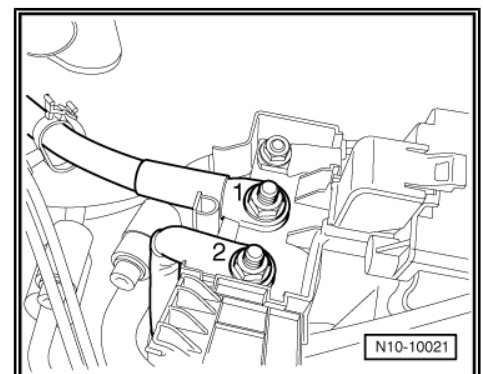
- Remove intake hose -A-.
- Pull vacuum hoses off exhaust gas recirculation valve, intake manifold changeover vacuum actuator and turbocharger.
- Remove crankcase breather hose from cylinder head cover.
- Release clip of air filter connecting hose on engine, then disconnect hose.
- Extract air conditioning system refrigerant ⇒ Heating, air conditioning system; Rep. gr. 87 .
- Unscrew refrigerant lines from air conditioner compressor.
- Remove noise insulation: ⇒ General body repairs, exterior; Rep. gr. 50 ; Body - front; Assembly overview - noise insulation



WARNING

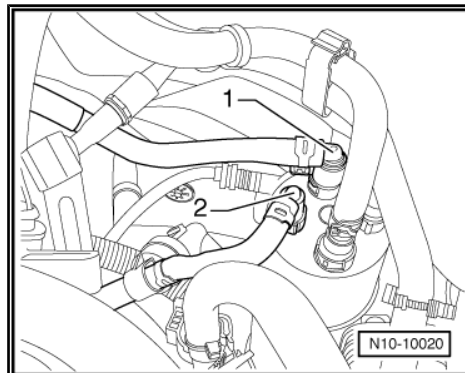
We recommend removing the »lower connecting bolts« for the engine/gearbox flange on all Touareg's, including this one, before removing the engine/gearbox assembly. If possible, you should also fit the attachment for the torque converter as early as possible. This is valid when removing and reinstalling the gearbox.

- Drain off coolant: ⇒ [page 72](#) .
- Disconnect starter cable -1- and alternator cable -2-, and place on engine.

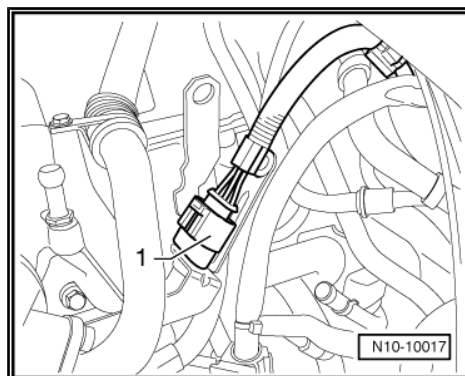




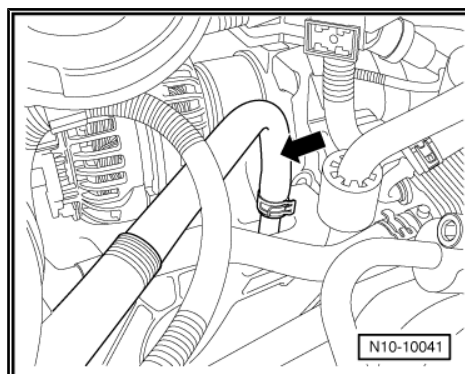
- Pull fuel supply hose -1- and fuel return hose -2- off fuel filter.
- Remove brake servo vacuum supply hose from tandem pump.



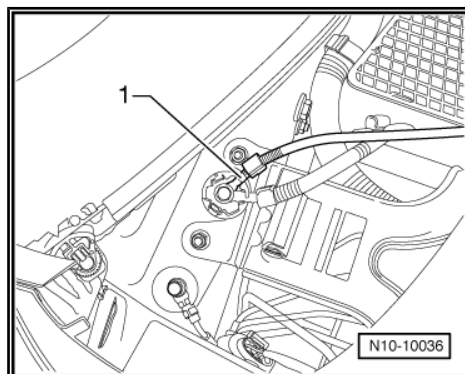
- Disconnect glow plugs connector -1-.
- Pull all necessary coolant hoses off engine.



- Clamp off power-assisted steering oil hose -arrow- with hose clips up to 40 mm Ø -3093-, loosen clip and disconnect hose from power steering pump.
- Pull engine compartment seal off plenum chamber bulkhead.
- Remove plenum chamber cover.
- Unclip engine control unit from mountings (on right in plenum chamber) and pull connector off engine control unit.

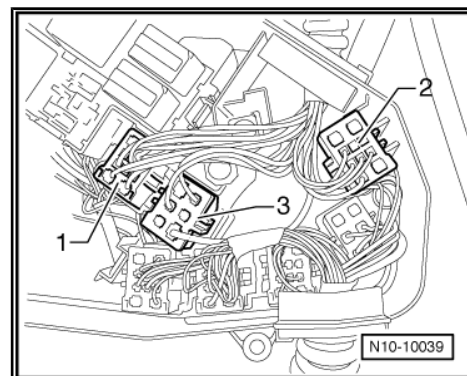


- Disconnect earth connection -1- from engine control unit wiring harness.

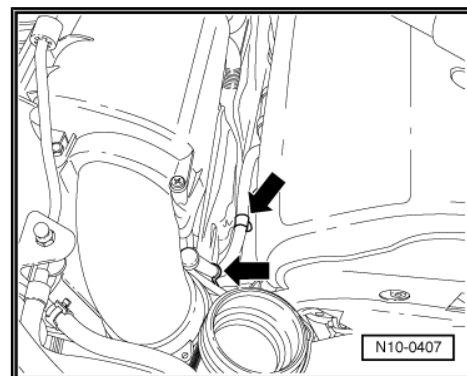




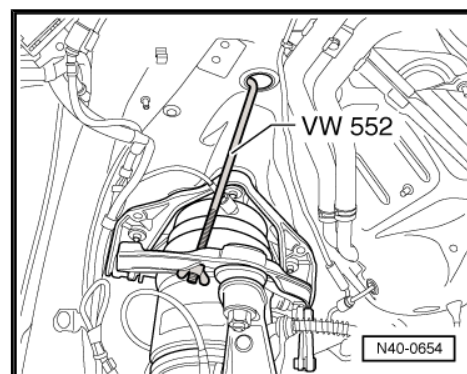
- Open fuse holder cover in plenum chamber on left and separate connectors -1-, -2- and -3-.
- Remove wiring harness (smaller connection on engine control unit) from plenum chamber and lay aside on engine.



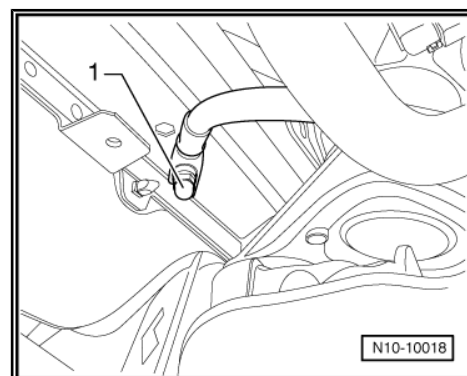
- Unclip line for gearbox breather -arrows-.



- Secure suspension strut, as shown, with spring compressor - VW 552- .
- Remove upper bolts of suspension strut: ⇒ Running gear; Rep. gr. 40 ; Front suspension .

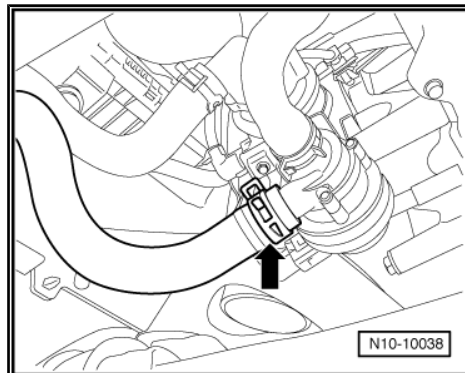


- Disconnect engine earth connection -1-.

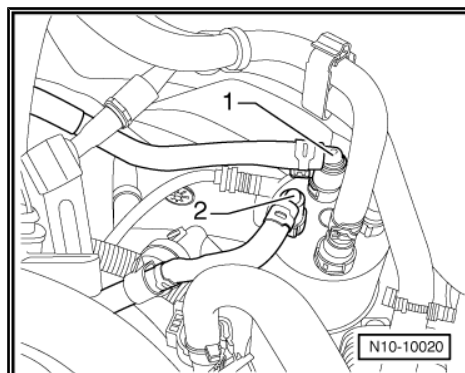




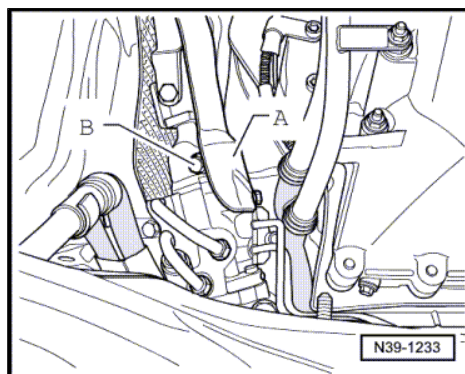
- Pull coolant hose -arrow- off continued coolant circulation pump.
- Remove connecting hose between turbocharger and charge air pipe.



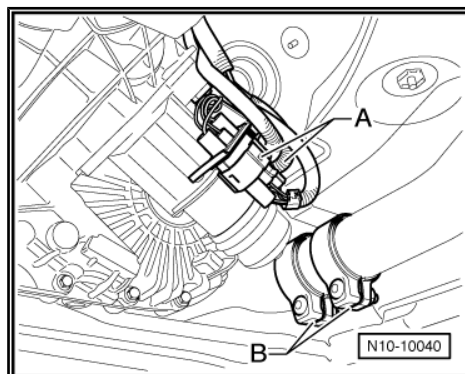
- Pull additional heater coolant hoses -arrows- off and place to the side so that they are not torn off when removing the engine.
- Remove heat shield -A- (if fitted) from steering box (2 bolts).



- Unscrew universal joint bolt -B- from steering box, and pull universal joint off steering box.
- Remove bracket for catalytic converter on underbody.
- Disconnect connectors -A- from gearbox.



- Release exhaust system clip -B- and push to rear.
- Remove propshaft tube ⇒ Transfer box and final drive; Rep. gr. 39 ; Removing and installing propshaft .

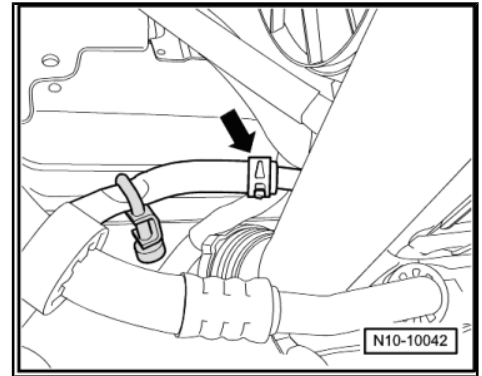




- Clamp off power steering oil line to cooler with hose clips up to 40 mm Ø -3093-, loosen clip and pull hose off cooler. Collect escaping oil.

Vehicles with automatic gearbox

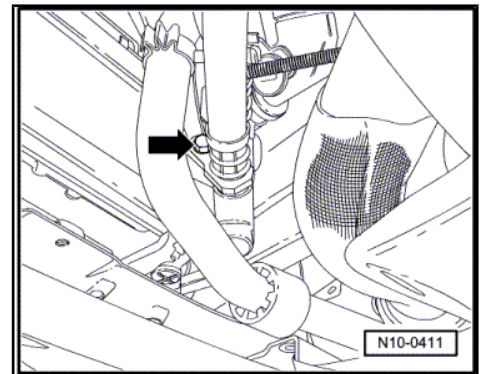
- Disconnect connectors on gearbox and transfer box ⇒ Automatic gearbox 09C; Rep. gr. 37 .
- Remove selector cable from gearbox ⇒ Automatic gearbox 09C; Rep. gr. 37 .



- Disconnect lines on lower right of radiator -arrow- for gearbox oil. Collect escaping oil.

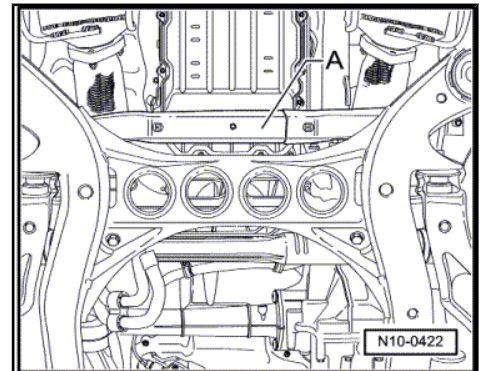
Vehicles with manual gearbox

- Remove clutch slave cylinder ⇒ Rep. gr. 30 ; Clutch mechanism; Removing and installing clutch slave cylinder .



Continuation for all vehicles

- Remove gearbox transverse support -A-.



- Disconnect brake line at point shown -arrow-. Collect brake fluid which runs out.

Preparing scissor-type assembly platform -VAS 6131 - for further procedure:

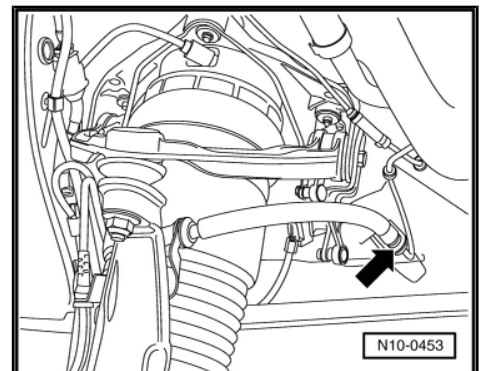


Note

The vehicle specific mounting set VAS 6131/6 consists of supports VAS 6131/6-1 to VAS 6131/6-7. Support 1 (for VAS 6131/6-1) to support 7 (for VAS 6131/6-7) are mentioned to provide a better overview of the following procedures.

- Assemble support 1 left and support 2 right (arrows point forwards) on assembly platform -VAS 6131- and secure bolts at following positions:

Support 1: A 5, B 4 and B 5





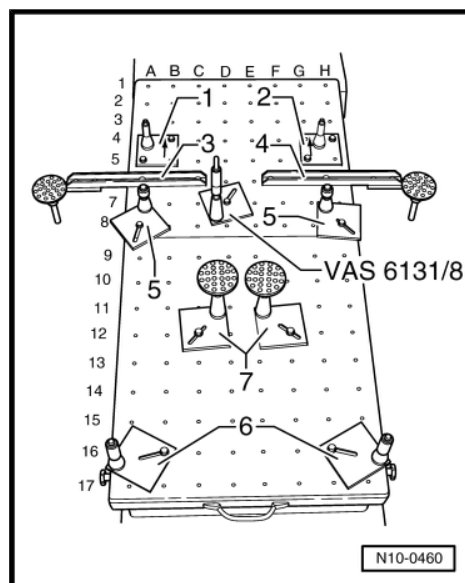
Support 2: G 4, H 4 and H 5

- Bolt support 3 and support 4 to scissor-type assembly platform at following positions:

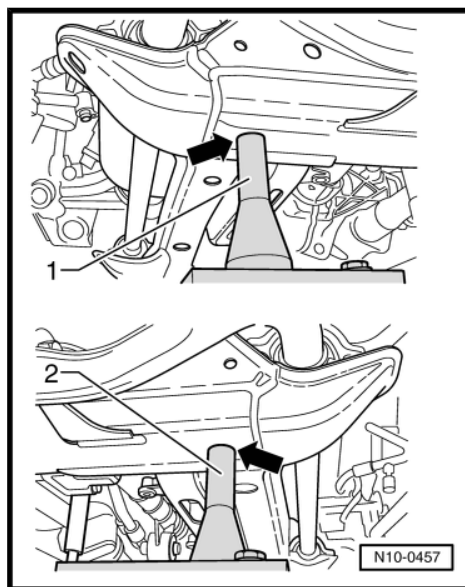
Support 3: A 6 and B 5

Support 4: F 6 and H 6

- Screw turntables of supports 3 and 4 downwards.
- Place support 5 for subframe and support 6 for gearbox transverse support in appropriate positions on scissor-type assembly platform.
- Fix subframe in position ⇒ Running gear, axles, steering; Rep. gr. 40 ; Fixing subframe in position .



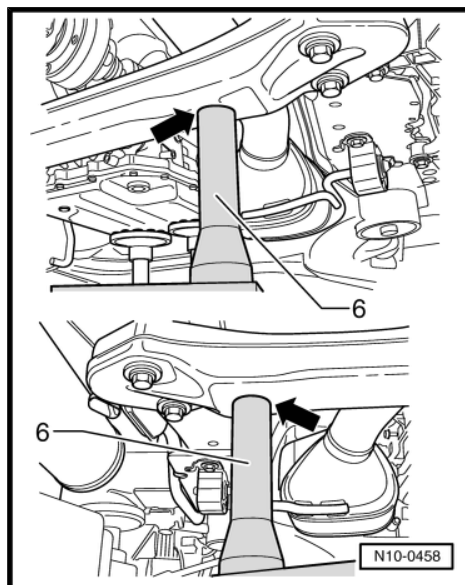
- Position horizontal scissor-type assembly platform under engine/gearbox assembly. The supports -1- and -2- must be guided into corresponding mountings on left and right -arrow-.



- At the same time, guide the supports -6- for the left and right sides of the gearbox transverse into corresponding hole -arrow-.

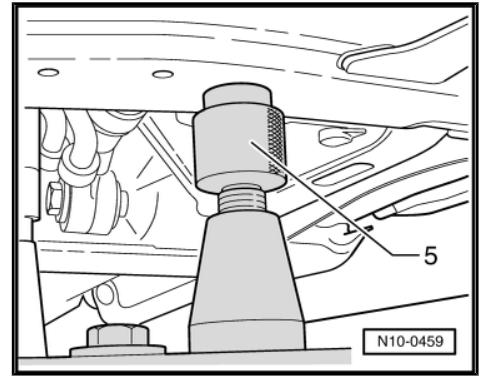
When all 4 supports are located in the mountings without pressure:

- Screw both turntables of axle supports under wishbones (with slight pretension), until the spring compressor -VW 552- can be removed.





- Guide supports 5 into their respective mountings in subframe -arrow-, correcting support height as necessary with knurled nuts.



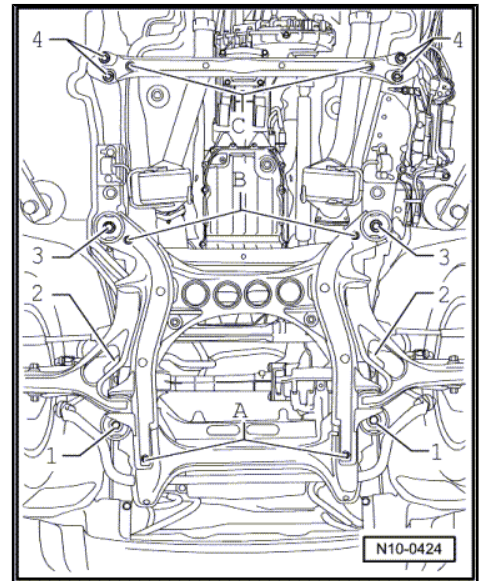
- Loosen subframe bolts -1-, -2- and -3- as well as gearbox transverse support -4-.

Specified torque gearbox carrier -4- to body ⇒ Rep. gr. 34 ; Installing transfer box, gearbox carrier and console



Note

- ◆ *Engine and gearbox must be guided carefully when lowering to prevent damage to the bodywork.*
- ◆ *If the subframe is not fixed on body, after reinstalling it is necessary to perform wheel alignment on the vehicle.*
- Now slowly lower engine/gearbox assembly, constantly observing the clearance.

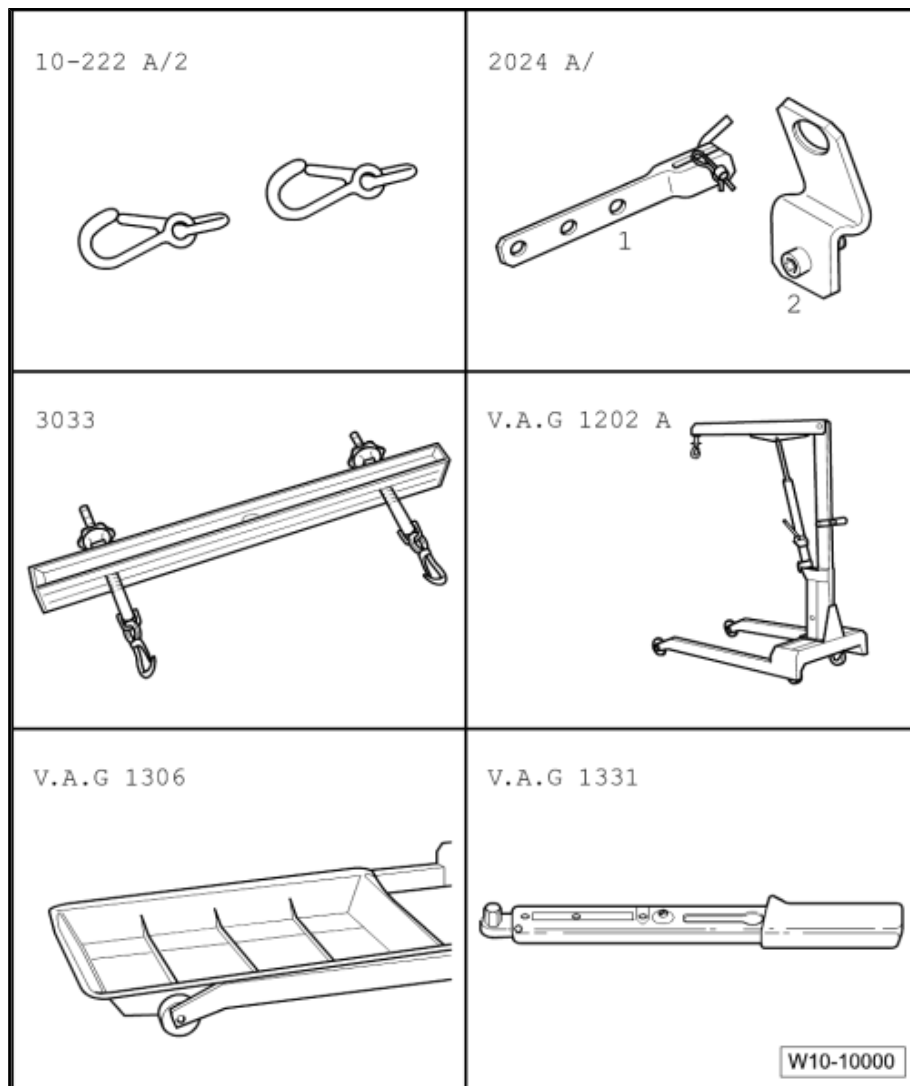




1.2 Removing engine from scissor-type assembly platform

Special tools and workshop equipment required

- ◆ Hooks -10-222A/2-
- ◆ Lifting eye -2024A/2-
- ◆ Lifting tackle -2024 A-
- ◆ Lifting tackle -3033-
- ◆ Workshop crane -V.A.G 1202A- or workshop crane -VAS 6100- with lifting tackle -3033-
- ◆ Drip tray -V.A.G 1306- or drip tray for workshop hoist -VAS 6208-
- ◆ Torque wrench -V.A.G 1331- (5...50 Nm)



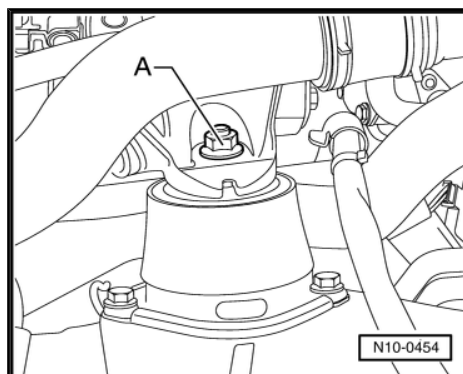
- Unbolt gearbox from engine: ⇒ Manual gearbox; Rep. gr. 34 ; Removing and installing gearbox .

Vehicles with automatic gearbox

- Unbolt gearbox from engine: ⇒ Automatic gearbox 09D; Rep. gr. 37 ; Removing and installing gearbox .

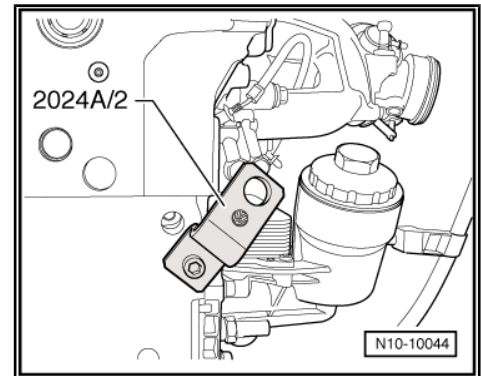
Continuation for all vehicles

- Remove assembly mounting nut/bolt -A- on both sides of engine.

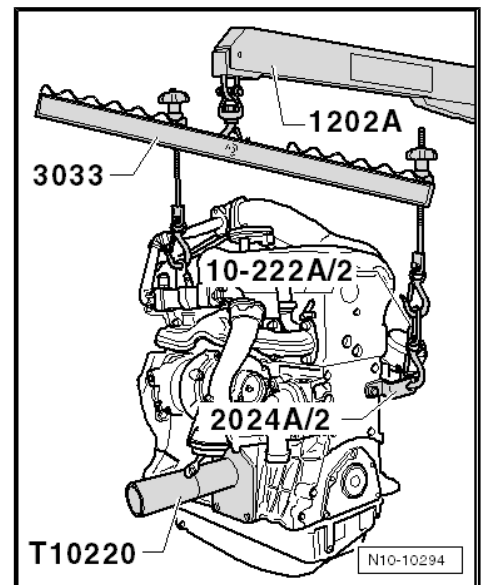




- Fit lifting tackle -2024 A- on cylinder block as shown.



- Attach lifting tackle -3033- together with hooks -10-222 A/2- to crane and transportation plates, and lift engine off scissor-type assembly platform, as shown.



1.3 Securing engine to assembly stand

Engine codes BAC and BLK

Before carrying out repair work, secure engine on assembly stand with engine and gearbox support -T10220- .

Procedure

- Unbolt gearbox from engine ⇒ Manual gearbox; Rep. gr. 34 ;
Removing and installing gearbox ⇒ Automatic gearbox 09C;
Rep. gr. 37 .
- Remove engine bracket from cylinder head.



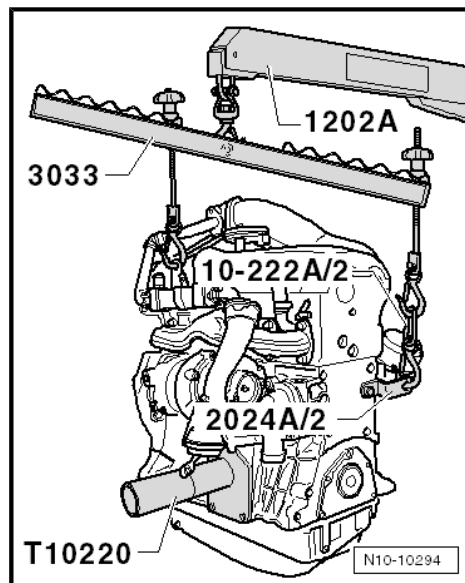
- Fit lifting eye -2024A/2- to cylinder block and tighten to 40 Nm
- Fit engine and gearbox support -T10220- as shown and tighten to 40 Nm.
- Secure engine to assembly stand with engine and gearbox support -T10220- .

Engine codes BPD and BPE

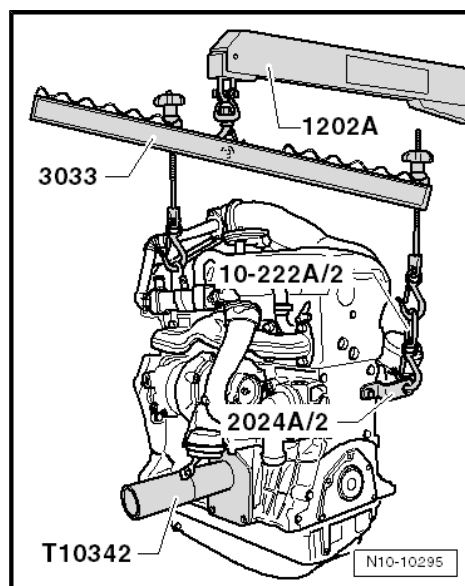
Before carrying out repair work, secure engine on assembly stand with engine and gearbox support -T10342- .

Procedure

- Unbolt gearbox from engine ⇒ Manual gearbox; Rep. gr. 34 ; Removing and installing gearbox ⇒ Automatic gearbox 09C; Rep. gr. 37 .
- Remove engine bracket from cylinder head.



- Fit lifting eye -2024A/2- to cylinder block and tighten to 40 Nm
- Fit engine and gearbox support -T10342- as shown and tighten to 40 Nm.
- Secure engine to assembly stand with engine and gearbox support -T10342- .



1.4 Additional information and assembly work for vehicles with air conditioner



Note

- ♦ Always observe the notes on installing air conditioner compressor ⇒ Heating, air conditioning system; Rep. gr. 87 .
- ♦ To prevent damage to condenser or to refrigerant lines/hoses, ensure that the lines and hoses are not stretched, kinked or bent.
- Remove air conditioner compressor ⇒ Heating, air conditioning system; Rep. gr. 87 .



1.5 Installing engine



Note

When moving engine/gearbox into body it is essential to position the subframe relative to the body with aid of scissor-type assembly platform. „Pulling up“ the subframe with the securing bolts will damage thread inserts.

Installation is carried out in the reverse order. When installing, note the following:

Specified torques ➔ [page 18](#) , assembly mounting.

Vehicles with manual gearbox

- Install hydraulic clutch slave cylinder ➔ 6-speed manual gearbox 0A5; Rep. gr. 30 ; Repairing clutch mechanism .
- Install selector mechanism and adjust cables if necessary ➔ 6-speed manual gearbox 0A5; Rep. gr. 34 ; Repairing selector mechanism; Removing and installing selector cables .

Vehicles with automatic gearbox

- Install selector lever cable on gearbox ➔ Rep. gr. 37 ; Selector mechanism; Assembly overview - selector lever cable .
- Top up ATF level ➔ Automatic gearbox 09D; Rep. gr. 37 ; Checking ATF level and topping-up.

Continuation for all vehicles

- Electrical connections and routing: ➔ Electrical system; Rep. gr. 97 .
- Install subframe: ➔ Running gear, axles, steering; Rep. gr. 40 ; Removing and installing subframe
- Reconnect air conditioning lines: ➔ Heating, air conditioning system; Rep. gr. 87 ; Repairing components of refrigerant circuit .
- Replenish coolant ➔ [page 72](#) .
- Replenish oil in power-assisted steering: ➔ Running gear, axles, steering; Rep. gr. 48 ; Checking power-assisted steering system oil level.
- Install noise insulation.
- Carry out a road test and read event memory ➔ [page 139](#)
Reading and clearing event memory of engine control unit.



2 Assembly mountings

⇒ „2.1 Assembly overview - engine mountings“, page 18

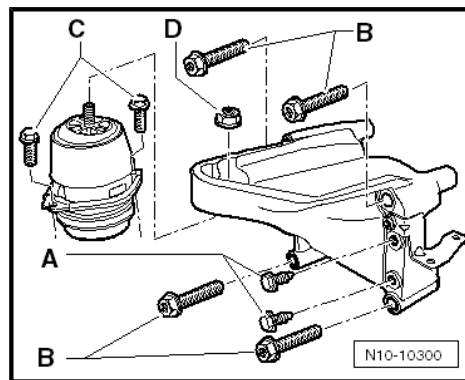
⇒ „2.2 Specified torques - Assembly mountings“, page 18

2.1 Assembly overview - engine mountings

Specified torques

Engine assembly mountings

- | | | |
|-----|-----------------------------------|-------|
| A - | Bracket for additional water pump | 20 Nm |
| B - | Engine bracket to cylinder block | 55 Nm |
| C - | Engine mounting | 60 Nm |
| D - | Engine bracket to engine mounting | 75 Nm |



2.2 Specified torques - Assembly mountings

Threaded connection		Specified torque
Bolts, nuts	M6	10 Nm
	M7	15 Nm
	M8	25 Nm
	M10	40 Nm
	M12	60 Nm

Specified torques gearbox carrier to body ⇒ Rep. gr. 34 ; Installing transfer box, gearbox carrier and console .



13 – Crankshaft group

1 Dismantling and assembling engine

⇒ „1.1 Dismantling and assembling engine, parts I-III“,
page 19

⇒ „1.2 Removing and installing crankshaft“, page 24

⇒ „1.3 Removing and installing drive plate“, page 25

⇒ „1.4 Crankshaft bearing cap identification“, page 26

⇒ „1.5 Crankshaft dimensions“, page 27

⇒ „1.6 Renewing crankshaft oil seal - engine timing end“,
page 27

⇒ „1.7 Renewing alternator shaft oil seal“, page 28

1.1 Dismantling and assembling engine, parts I-III



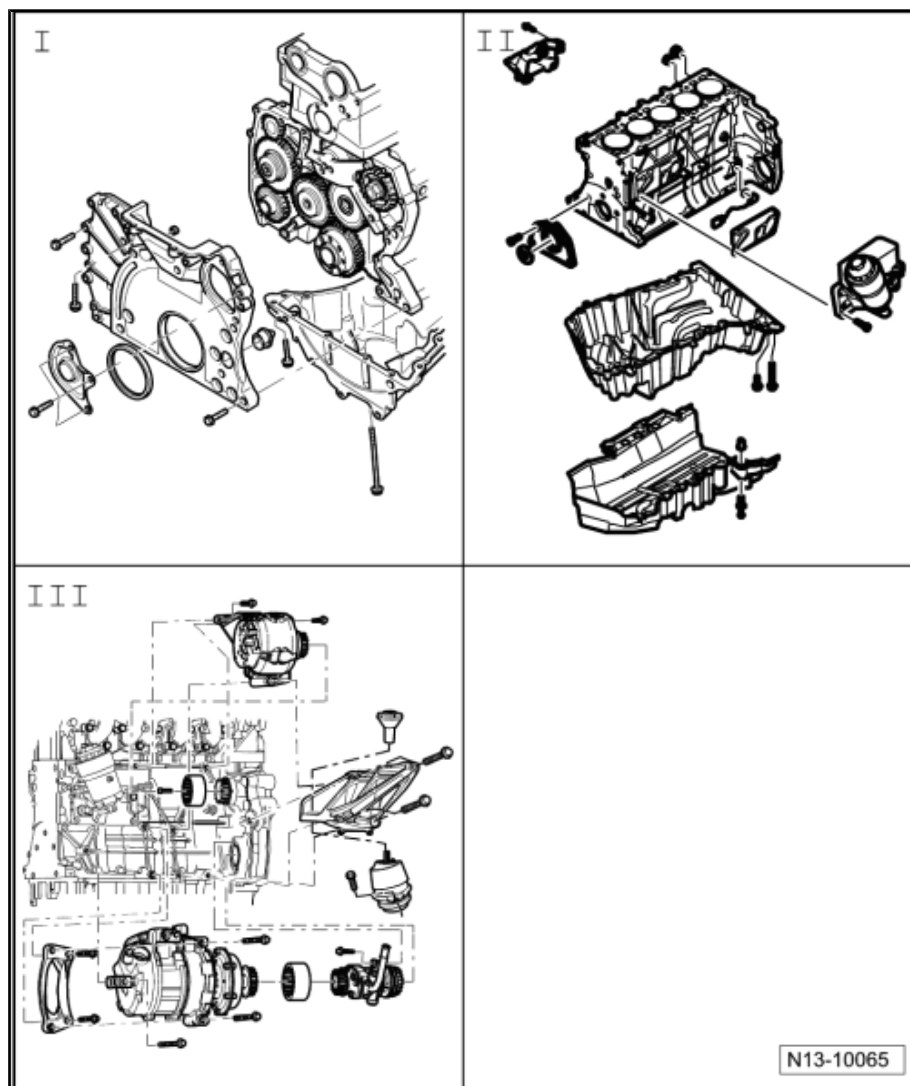
Note

- ◆ *If large quantities of swarf or metal particles (caused, for example, by partial seizure of the crankshaft or conrod bearings) are found in the engine oil when performing repairs, clean the oil galleries thoroughly and renew the engine oil cooler in order to prevent subsequent damage.*
- ◆ *Engine must not be set down on oil sump, as this will damage the oil sump liquid gasket.*
- ◆ *Secure engine to engine and gearbox support -VAS 6095- to carry out repairs.*

⇒ „1.1.1 Part I“, page 21

⇒ „1.1.2 Part II“, page 22

⇒ „1.1.3 Part III“, page 23





1.1.1 Part I

1 - Gear train housing cover

- ☐ Must seat on dowel sleeves.
- ☐ Must be removed to allow for removal of sump and cylinder head.
- ☐ Insert with sealant according to ⇒ Electronic parts catalogue (ETKA) ⇒ [page 22](#).

2 - Rubber sleeve

- ☐ Renew.

3 - Cylinder block

- ☐ With gear train.

4 - Cylinder head

- ☐ Removing and installing ⇒ [page 34](#)

5 - Gear wheel

- ☐ For coolant pump.
- ☐ Removing and installing coolant pump ⇒ [page 77](#).

6 - Oil sump

- ☐ Clean sealing surface before fitting.
- ☐ Install with sealant according to ⇒ Electronic parts catalogue (ETKA) ⇒ [page 62](#).

7 - 15 Nm

8 - Plug

- ☐ Renew if damaged.

9 - 20 Nm

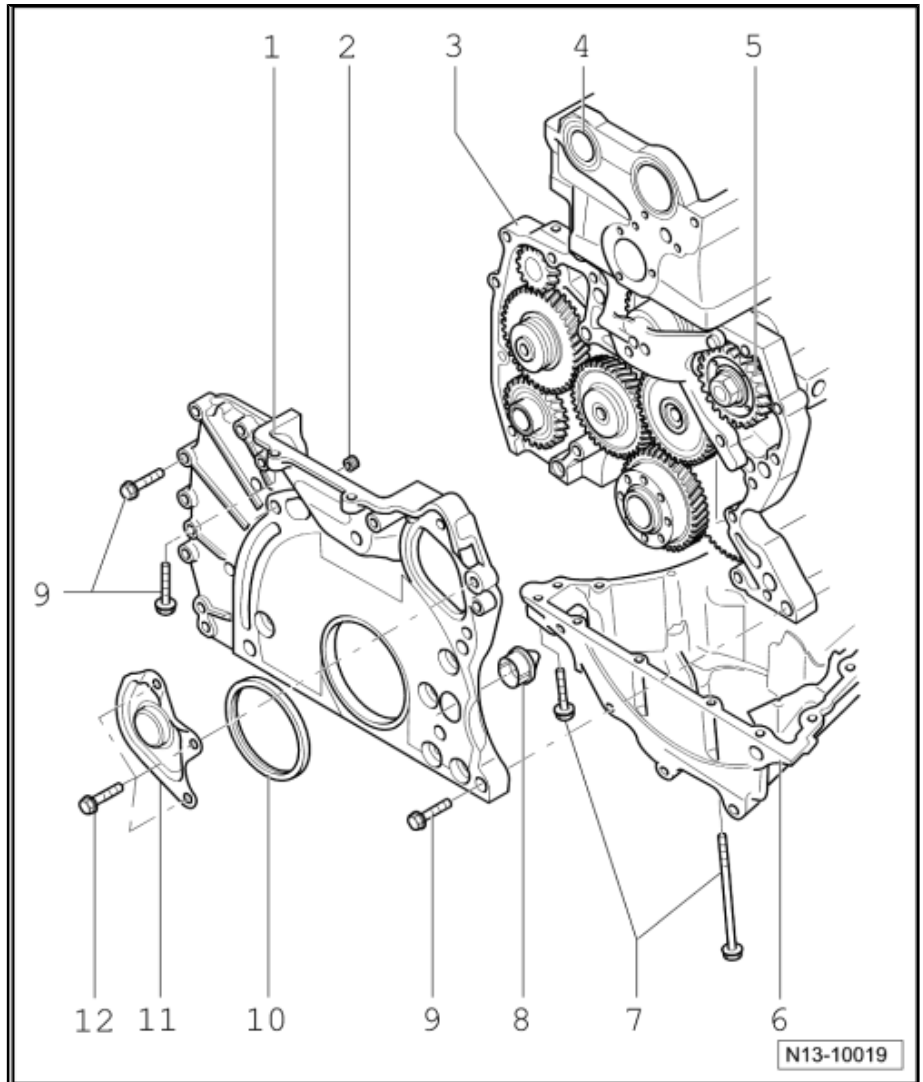
10 - Seal

- ☐ Do not additionally oil or grease the oil seal sealing lip.
- ☐ Before installing, remove oil residue from crankshaft journal using a clean cloth.
- ☐ Renew. ⇒ [page 27](#).

11 - Cover

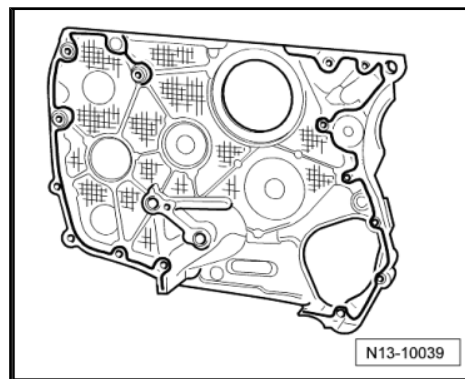
- ☐ For coolant pump.
- ☐ Renew seal if damaged.

12 - 20 Nm





Sealant bead on gear train housing



1.1.2 Part II

1 - Plug, 20 Nm

- ❑ Remove to remove coolant pump.

2 - Plug, 20 Nm

- ❑ Remove to remove coolant pump.

3 - O-ring

- ❑ Renew.

4 - Engine speed sender -G28-

- ❑ Tighten on cylinder block to 10 Nm.

5 - Oil filter housing

- ❑ With engine oil cooler.
- ❑ Dismantling and assembling ⇒ [page 58](#) .

6 - 20 Nm

7 - Gasket

- ❑ Renew.

8 - 15 Nm

9 - Retaining clip

10 - Noise insulation

- ❑ For oil sump.

11 - Oil sump

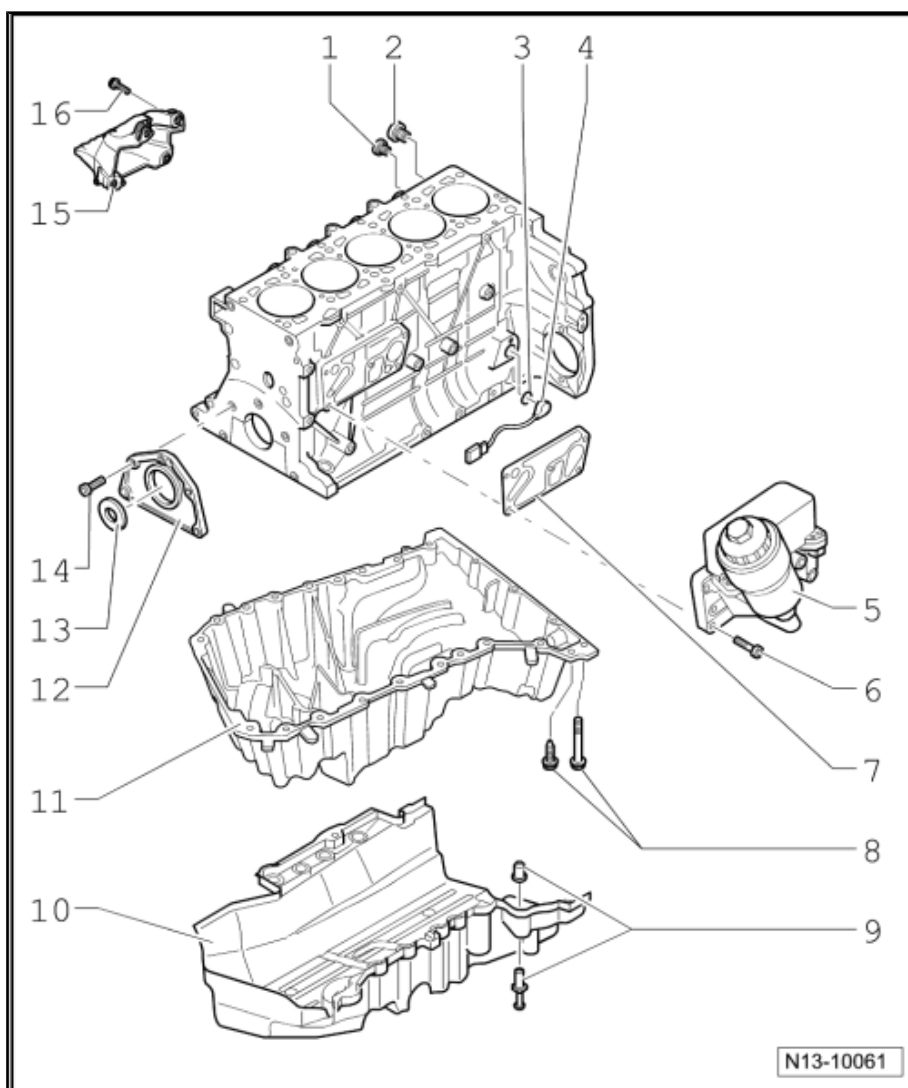
- ❑ Clean sealing surface before fitting.
- ❑ Install with sealant according to ⇒ Electronic parts catalogue (ETKA) ⇒ [page 62](#) .

12 - Sealing flange

- ❑ Renew seal if damaged.

13 - Cover

- ❑ Renew.





14 - 10 Nm

15 - Right engine support

16 - 50 Nm + 90° further

☐ Renew.

1.1.3 Part III

1 - Alternator

- ☐ The bolts between alternator and alternator bracket must not be loosened.
- ☐ Removing and installing
⇒ Electrical system;
Rep. gr. 27 ; Alternator;
Removing and installing alternator .

2 - 20 Nm

3 - Balance weight

- ☐ Tighten to 75 Nm.

4 - 50 Nm + 90° further

- ☐ Renew.

5 - Left engine support

6 - Engine mounting

7 - 60 Nm

8 - Power-assisted steering vane pump

- ☐ Removing and installing
⇒ Running gear, axles, steering; Rep. gr. 48 ;
Vane pump, hydraulic lines, storage tank with suction hoses; Removing and installing vane pump .

9 - 55 Nm

- ☐ Renew.

10 - Elastic drive coupling

- ☐ Renew if damaged.

11 - Hexagon bolt

- ☐ Specified torque ⇒ Heating, air conditioning system; Rep. gr. 87 ; Air conditioning compressor; Removing and installing air conditioning compressor from and to bracket

12 - Air conditioner compressor

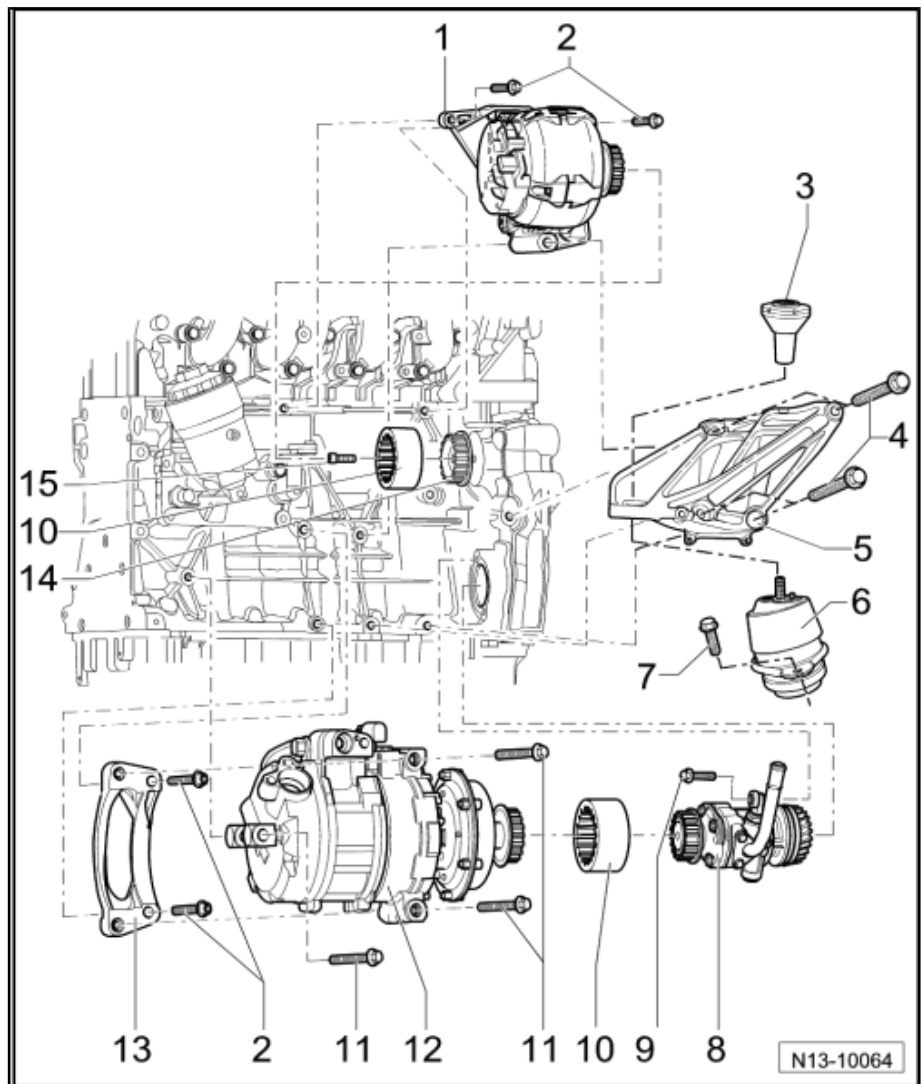
- ☐ Removing and installing ⇒ Heating, air conditioning system; Rep. gr. 87 ; Air conditioning compressor; Removing and installing air conditioning compressor from and to bracket

13 - Bracket

- ☐ For air conditioner compressor.
- ☐ Note dowel sleeves between bracket/cylinder block and bracket/air conditioner compressor.

14 - Hub

- ☐ For alternator shaft.





15 - 50 Nm + 90° further

- ☐ Renew.

1.2 Removing and installing crankshaft

Repairing clutch ⇒ 6-speed manual gearbox 0A5; Rep. gr. 30 ;

Repairing clutch

1 - Tie bolt, 30 Nm

- ☐ Renew.
- ☐ If the tie bolts are to be loosened then the cylinder head bolts must be removed and the cylinder head removed from the block first
⇒ [page 34](#) .

2 - Bearing cap

- ☐ Bearing cap 4 with recesses for thrust washers.
- ☐ Bearing shell retaining lugs in cylinder block and bearing caps must align.

3 - Thrust washer

- ☐ For bearing 4.

4 - Bearing shell 4

5 - Crankshaft

- ☐ If the crankshaft is to be removed, first remove cylinder head bolts and cylinder head before loosening crankshaft bearings.
- ☐ Axial clearance new: 0.07...0.231 mm, wear limit: 0.250 mm.
- ☐ Check radial clearance using Plastigage: 0.026...0.040 mm, wear limit: 0.16 mm
- ☐ Do not rotate crankshaft when checking radial clearance.
- ☐ Crankshaft dimensions ⇒ [page 27](#) .

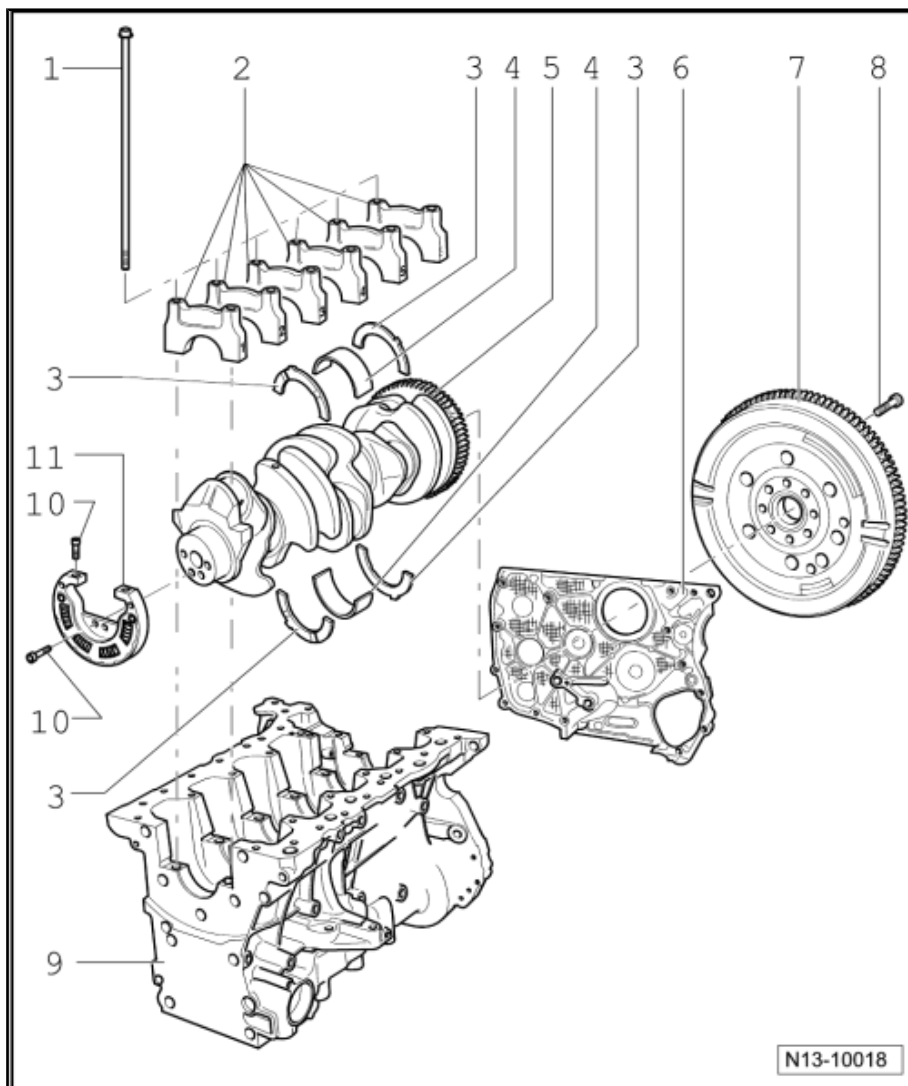
6 - Gear train housing cover

- ☐ Insert with sealant according to ⇒ Electronic parts catalogue (ETKA) ⇒ [page 22](#) .
- ☐ With seal.
- ☐ Use fitting tool -T10122- to pretension seal before installing.
- ☐ Do not additionally oil or grease the oil seal sealing lip.
- ☐ Before installing, remove oil residue from crankshaft journal using a clean cloth.
- ☐ Renewing seal ⇒ [page 27](#) .

7 - Flywheel/drive plate

Engine code: BAC.

Only vehicles with manual gearbox up to engine number 05984.





When replacing a defective dual-mass flywheel, the vibration damper ⇒ [Item 11 \(page 25\)](#) must always be replaced.

- ☐ When removing and installing flywheel, lock with counterhold -3067- .
- ☐ Removing and installing drive plate ⇒ [page 25](#) .

8 - 60 Nm + 90° further

- ☐ Renew.

9 - Cylinder block

10 - 20 Nm + 90° further

- ☐ Renew.

11 - Vibration damper

- ☐ To remove, remove conrod bearing cap of cylinder 1. Renew conrod bolts.
- ☐ When installing, tighten upper bolt to 5 Nm. Then first tighten front and then upper securing bolts to specified torque.

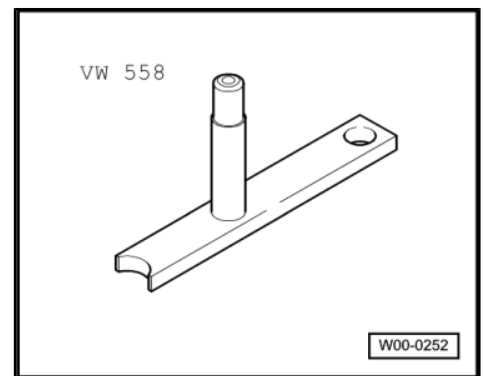
1.3 Removing and installing drive plate

⇒ „1.3.1 Loosening and tightening drive plate“, [page 26](#)

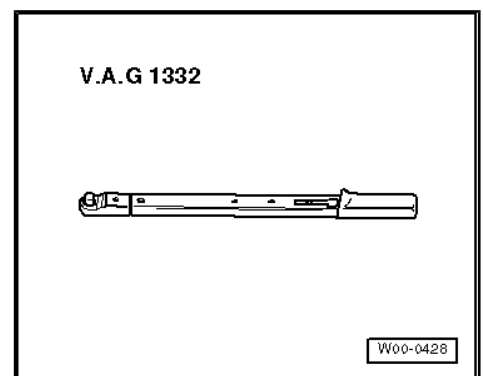
⇒ „1.3.2 Installing drive plate“, [page 26](#)

Special tools and workshop equipment required

- ◆ Clutch counterhold -VW 558-



- ◆ Torque wrench -V.A.G 1332-



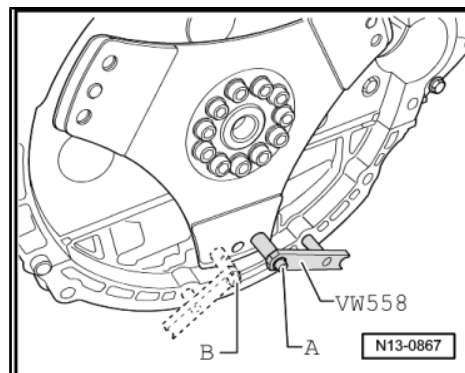
- ◆ Vernier gauge
- ◆ Hexagon bolt M8 × 50 with M12 hexagon nuts



1.3.1 Loosening and tightening drive plate

- Secure clutch counterhold -VW 558- to drive plate with hexagon bolt M8 x 50. Insert M12 hexagon nuts between counterhold and drive plate.

Installation position of counterhold: -A- when loosening; -B- when tightening



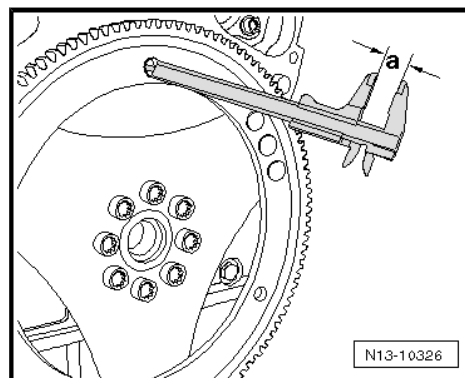
1.3.2 Installing drive plate

- Position drive plate with shim.
- Fit new bolts and tighten to 30 Nm.
- Use the caliper gauge to check the distance between the drive plate and gear train cover.

Specification dimension -a-: 18.1 mm...19.7 mm

If specification is not attained:

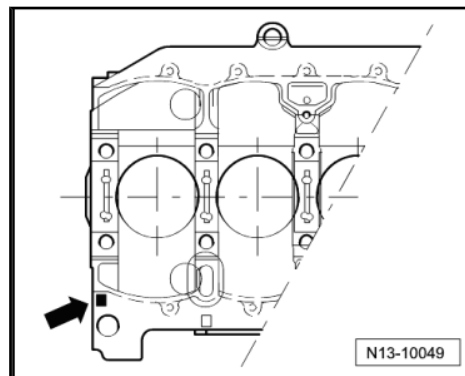
- Remove drive plate again and place shim between crankshaft and drive plate. Tighten bolts to 30 Nm again.
- Tighten bolts to 60 Nm + turn 90° further (turning further can be carried out in several stages).



1.4 Crankshaft bearing cap identification

The crankshaft bearing shells are classified during production and cylinder block and crankshaft sender wheel are marked as shown. When ordering bearing shells, remove oil sump and baffle plate, read the coloured mark and allocate the bearing shells accordingly.

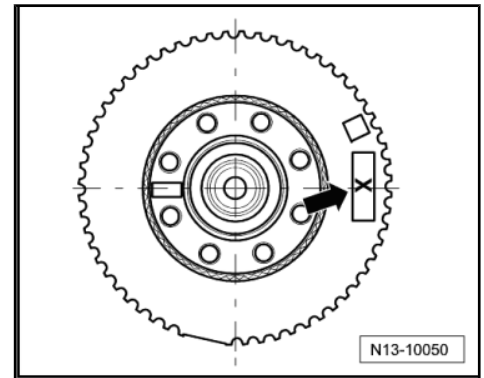
Identification of crankshaft upper bearing shell - arrow - (next to first main bearing).





Identification of crankshaft lower bearing shell - arrow - (on crankshaft sender wheel).

Colour coding		
B	=	Blue
G	=	Yellow
R	=	Red
S	=	Black



1.5 Crankshaft dimensions

No further honing dimensions are planned at this time.

(Dimensions in mm)

Honing dimension	Main journal Ø	Conrod journal Ø
Basic dimension	58.00	50.90
	-0.022 -0.037	-0.022 -0.042

1.6 Renewing crankshaft oil seal - engine timing end

⇒ „1.6.1 Removing“, page 27

⇒ „1.6.2 Installing“, page 27

Special tools and workshop equipment required

- ◆ Puller hooks -T20143/2-
- ◆ Assembly tool -T10122-

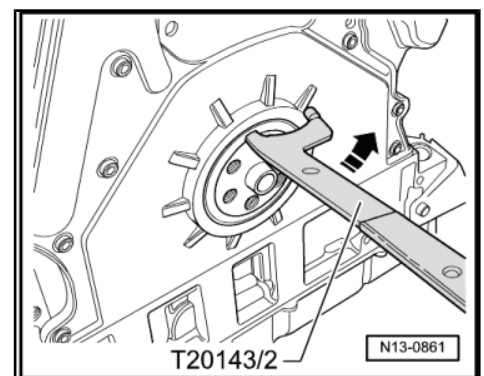
1.6.1 Removing



Note

Ensure that sealing surface is not damaged when removing seal.

- Pull old oil seal carefully out of seat using puller hook - T20143/2- .

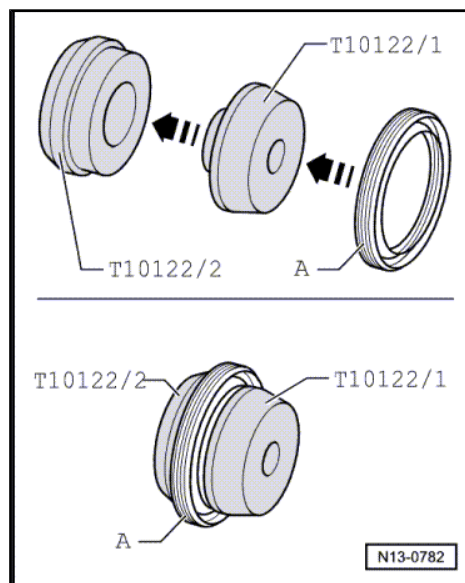


1.6.2 Installing

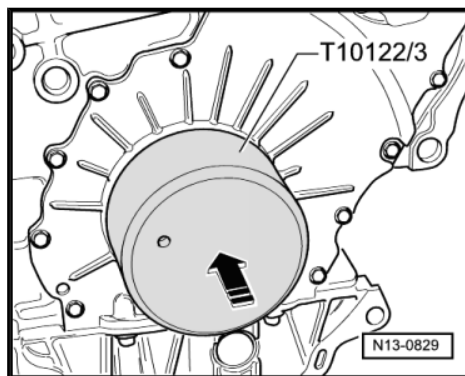
- Remove oil residue from crankshaft journal using clean cloth.



- Pull dry oil seal -A- with outer side over the sleeve -T10122/1- onto pulling sleeve -T10122/2- .
- Separate the two fitting sleeves.
- Then set pulling sleeve -T10122/2- with dry oil seal onto crankshaft stub.



- Press oil seal into gear train housing cover to stop using thrust piece -T10122/3- .



1.7 Renewing alternator shaft oil seal

⇒ „1.7.1 Removing“, page 28

⇒ „1.7.2 Installing“, page 29

Special tools and workshop equipment required

- ◆ Puller hooks -T20143/1-
- ◆ Assembly tool -T10208-
- ◆ Torque wrench -V.A.G 1332- (40 ... 200 Nm)



WARNING

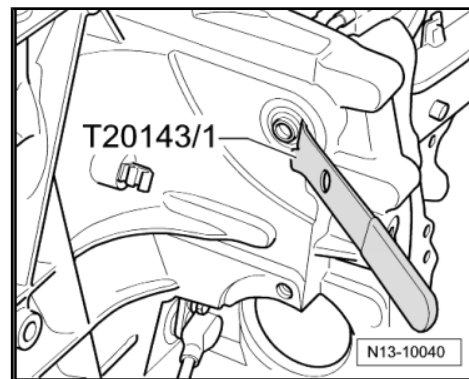
When loosening the threaded connection for the alternator drive hub, always counterhold at flats (WAF 27 mm) because otherwise the threaded connection inside the control housing may be loosened.

1.7.1 Removing

- Remove alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
- Remove hub from alternator shaft. To do this counterhold the hub with a 27 mm ring spanner.



- Pull old oil seal carefully out of seat using puller hook - T20143/1- .

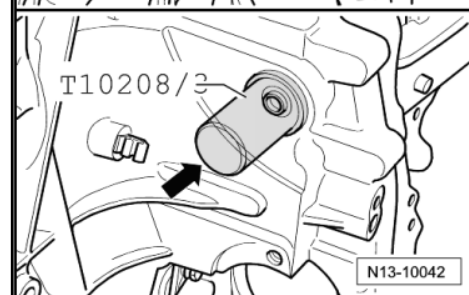
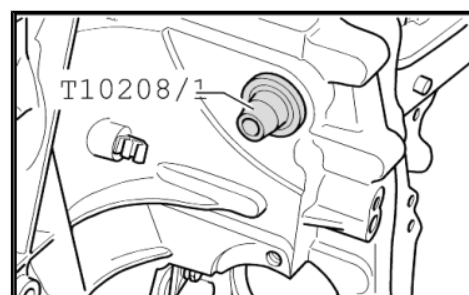


1.7.2 Installing

- Remove oil residue from alternator shaft using clean cloth.
- Screw guide sleeve -T10208/1- hand tight onto alternator shaft and carefully push seal onto stop.
- Now fit press piece -T10208/3- and press seal in onto limit stop.
- Secure hub onto alternator shaft with new bolts.

Specified torque: 50 Nm + turn 90° further.

- Install alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .





2 Dismantling and assembling pistons and conrods



Note

All bearing and running surfaces must be oiled before assembly.

⇒ „2.1 Assembly overview - pistons and conrods“, page 30

⇒ „2.2 Separating new conrods“, page 31

⇒ „2.3 Installation position and allocation of piston to cylinder“, page 32

⇒ „2.4 Checking piston ring gap“, page 32

⇒ „2.5 Checking ring-to-groove clearance“, page 32

⇒ „2.6 Checking cylinder bores“, page 33

⇒ „2.7 Piston and cylinder dimensions“, page 33

2.1 Assembly overview - pistons and conrods

1 - Piston rings

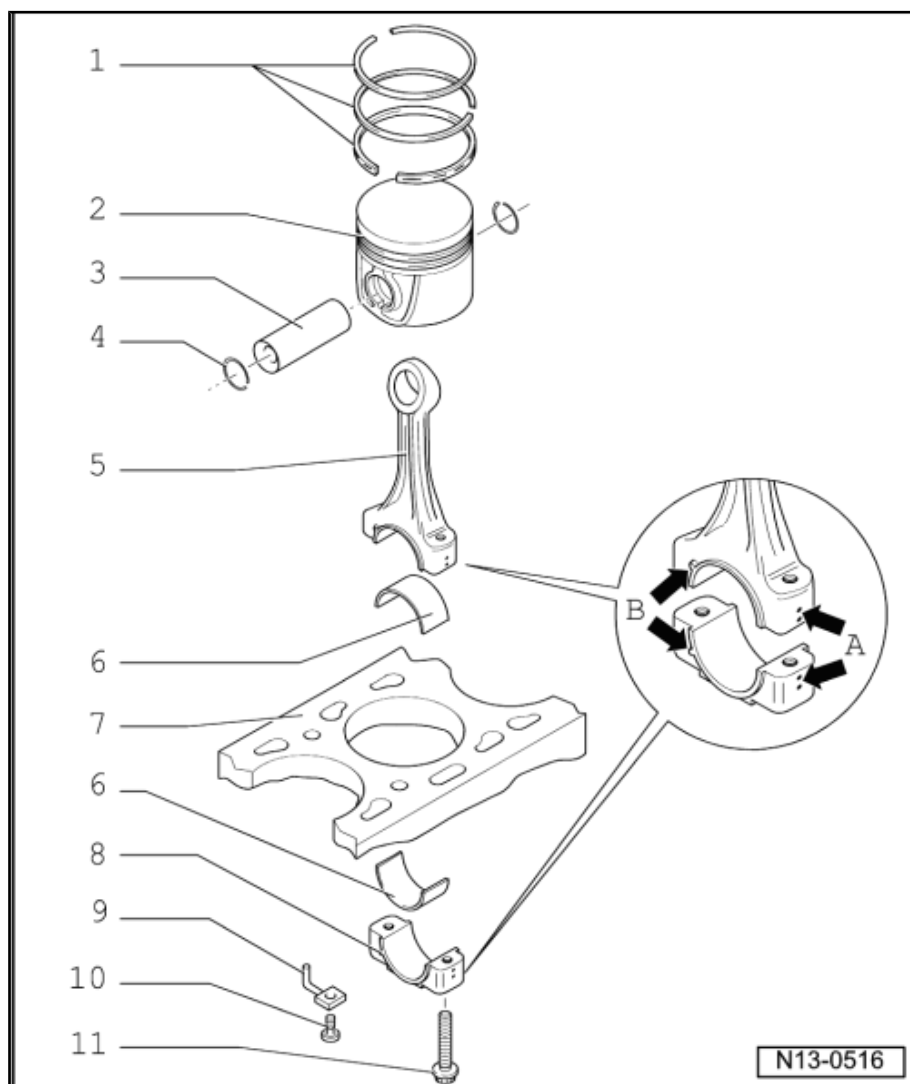
- ☐ Offset gaps by 120°.
- ☐ Use piston ring pliers to remove and install.
- ☐ „TOP“ faces towards piston crown.
- ☐ Checking ring gap
⇒ [page 32](#).
- ☐ Checking ring-to-groove clearance ⇒ [page 32](#).

2 - Piston

- ☐ With combustion chamber.
- ☐ Mark installation position and cylinder number.
- ☐ Installation position and allocation of piston to cylinder ⇒ [page 32](#).
- ☐ Arrow on piston crown points towards No. 1 cylinder end of engine block.
- ☐ Install using piston ring clamp.
- ☐ If piston skirt is cracked, renew piston.
- ☐ Installation position
⇒ [page 32](#).
- ☐ Piston and cylinder dimensions ⇒ [page 33](#).
- ☐ Checking cylinder bores
⇒ [page 33](#).

3 - Piston pin

- ☐ If difficult to remove, heat piston to 60 °C.





- ☐ Remove and install using drift -VW 222 A- .

4 - Circlip

5 - Conrod

- ☐ Renew as set only.
- ☐ Mark with cylinder number -A-.
- ☐ Installation position: Marking -B- faces towards No. 1 cylinder end.

6 - Bearing shell

- ☐ Note installation position.
- ☐ Upper bearing shell (towards piston) made of a more wear resistant material.
- ☐ Do not interchange used bearing shells.
- ☐ Insert bearing shells centrally.
- ☐ Check for secure seating.
- ☐ Axial clearance, wear limit: 0.37 mm
- ☐ Measure radial clearance with Plastigage: Wear limit: 0.08 mm, do not rotate crankshaft when measuring radial clearance.

7 - Cylinder block

- ☐ Checking cylinder bores ⇒ [page 33](#) .
- ☐ Piston and cylinder dimensions ⇒ [page 33](#) .

8 - Conrod bearing cap

- ☐ Note installation position.

9 - Oil spray jet

- ☐ For piston cooling.
- ☐ When installing, turn oil spray jet clockwise onto limit stop in cylinder block and tighten in this position.

10 - 25 Nm

- ☐ Insert without sealant.

11 - Conrod bolt, 30 Nm + turn (90°)

- ☐ Renew.
- ☐ Oil threads and contact surface.
- ☐ First tighten evenly to 5 Nm.
- ☐ Use old bolt for measuring radial clearance.

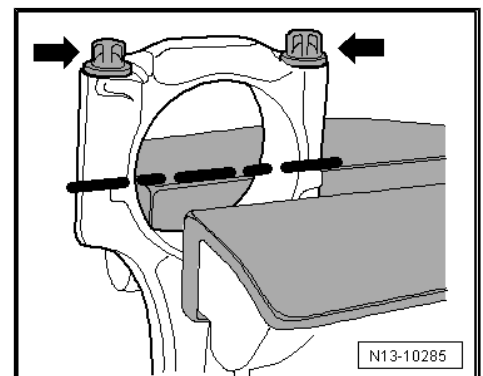
2.2 Separating new conrods

- Mark cylinder allocation of conrod ⇒ [Item 5 \(page 31\)](#)
- Lightly clamp the conrod in a vice using aluminium vice clamps, as shown in the illustration.



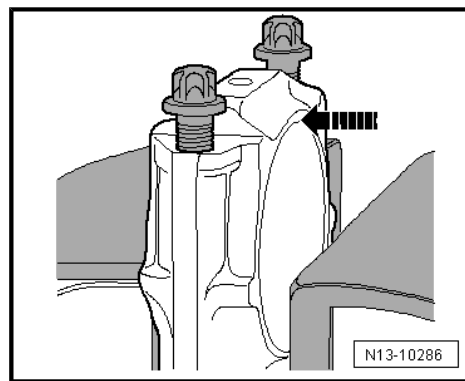
Note

- ◆ To prevent damage to the conrod, only clamp conrod in lightly.
- ◆ Clamp conrod in below the dashed line.
- Unscrew the two bolts -arrows- approx. 5 turns.





- Using a plastic hammer, carefully knock against conrod bearing cap in -direction of arrow- until it is loose.



2.3 Installation position and allocation of piston to cylinder

Installation position and allocation of piston to cylinder

Piston in cylinders 1 and 2:

Larger inlet valve chamber -arrows- towards flywheel.

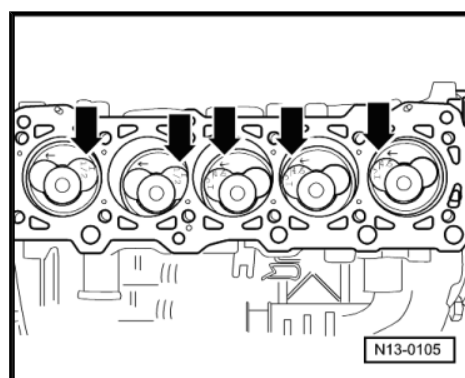
Piston in cylinders 3, 4 and 5:

Larger inlet valve chamber -arrows- towards No. 1 cylinder end of block.



Note

- ♦ *New piston allocation to cylinders is shown by a coloured marking on piston crown.*
- ♦ *Piston for cylinders 1 and 2: marked 1/2*
- ♦ *Piston for cylinders 3, 4 and 5: Marking 3/4/5*

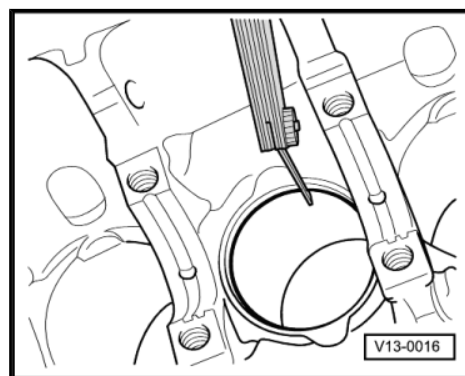


2.4 Checking piston ring gap

Checking piston ring gap

- Insert ring at right angles from above and push down into cylinder approx. 15 mm from bottom end of cylinder.

Piston ring dimensions in mm	New	Wear limit
1st compression ring	0.25 ... 0.40	1.0
2nd compression ring	0.30 ... 0.50	1.0
Oil scraper ring	0.25 ... 0.50	1.0

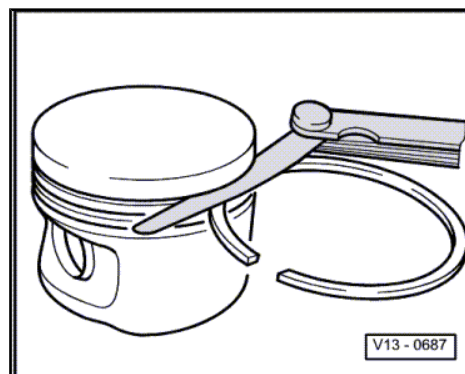


2.5 Checking ring-to-groove clearance

Checking ring-to-groove clearance

Clean annular groove before check.

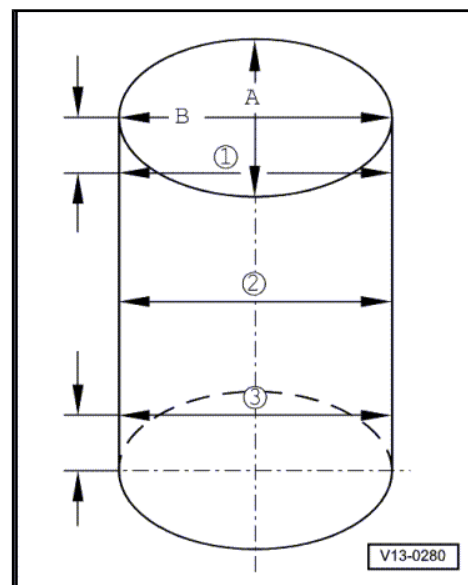
Piston ring dimensions in mm	New	Wear limit
1st compression ring	0.09 ... 0.13	0.25
2nd compression ring	0.04 ... 0.08	0.25
Oil scraper ring	0.03 ... 0.07	0.15





2.6 Checking cylinder bores

Checking cylinder bores



Special tools and workshop equipment required

- ◆ Internal dial test indicator 50...100 mm
- Take measurements at 3 positions in both lateral direction -A- and longitudinal direction -B-. Deviation from nominal dimension max. 0.08 mm

2.7 Piston and cylinder dimensions

No repairs designated.

		Piston Ø	Cylinder bore Ø
Basic dimension	mm	80.97	81.01



15 – Cylinder head, valve gear

1 Overview - cylinder head

- ⇒ „1.1 Assembly overview - cylinder head“, page 34
- ⇒ „1.2 Renewing pipe connection for coolant“, page 36
- ⇒ „1.3 Removing and installing camshaft drive gear“, page 37 .
- ⇒ „1.4 Setting engine to TDC No. 1 cylinder“, page 41
- ⇒ „1.5 Removing and installing cylinder head“, page 42
- ⇒ „1.6 Checking compression“, page 45 .



Note

- ◆ *When installing an exchange cylinder head with fitted camshaft.*
- ◆ *The contact surfaces between the bucket tappets and the cam must be oiled before installing the cylinder head cover.*
- ◆ *The plastic packing pieces for protecting the open valves must not be removed until immediately before fitting cylinder head.*
- ◆ *If the cylinder head is replaced, all the coolant in the system must also be renewed.*

1.1 Assembly overview - cylinder head

- ⇒ „1.1.1 Checking cylinder head for distortion“, page 36



1 - To air filter.

- ☐ Dismantling and assembling air filter
⇒ [page 138](#)

2 - Crankcase breather valve

3 - Seal

- ☐ Renew if damaged.

4 - Engine cover

5 - 15 Nm

6 - Cylinder head cover

- ☐ Before fitting, thoroughly clean sealing surface of cylinder head with clean cloth.

7 - Cylinder head bolt

- ☐ Renew.
- ☐ Note sequence when loosening and tightening ⇒ [page 42](#), Removing and installing cylinder head.

8 - 20 Nm

9 - Tandem pump

- ☐ For fuel and vacuum supply.
- ☐ Removing and installing ⇒ [page 107](#)
- ☐ Checking ⇒ [page 104](#).
- ☐ Must not be dismantled.

10 - 10 Nm

11 - Hall sender -G40-

- ☐ For camshaft position.

12 - O-ring

- ☐ Renew.

13 - Gasket

- ☐ Renew.

14 - Lifting eye

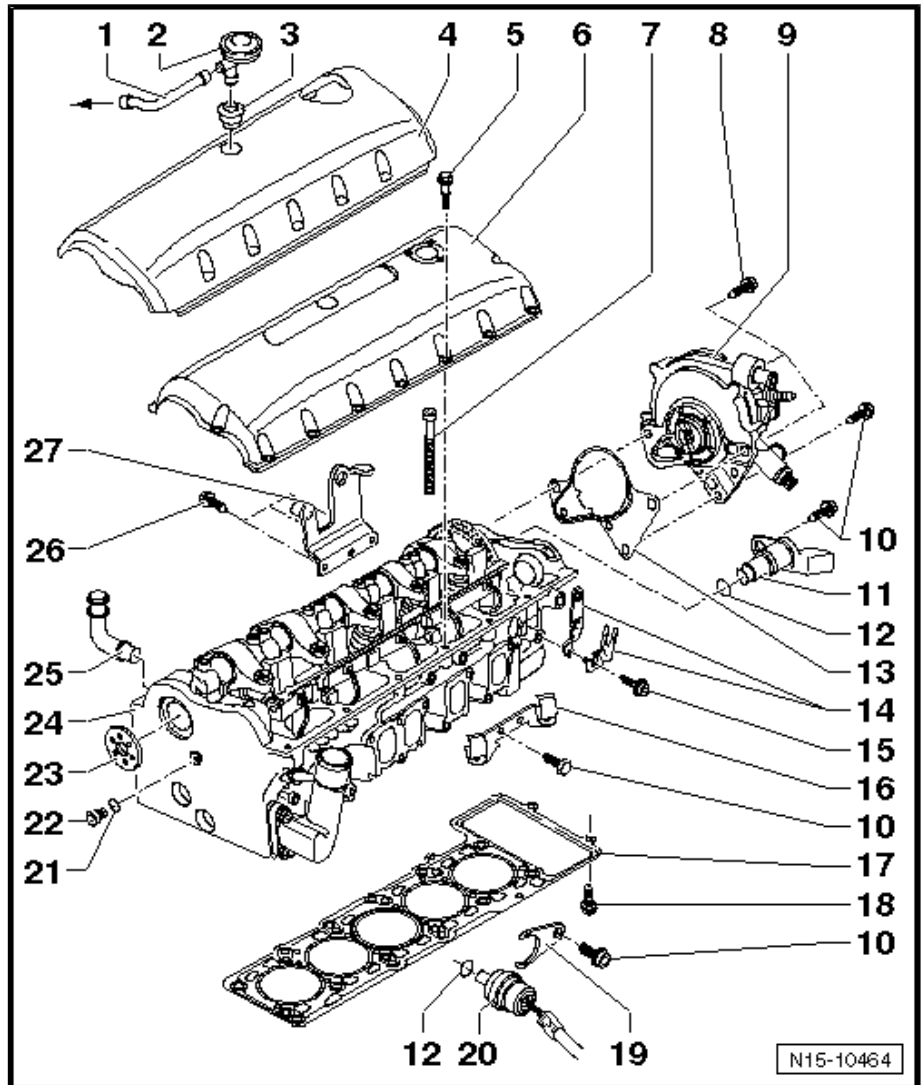
- ☐ With retainer for connector.

15 - 20 Nm

16 - Bracket

17 - Cylinder head gasket

- ☐ Renew.
- ☐ Imprint must be legible.
- ☐ After renewing, renew entire coolant.
- ☐ Different thicknesses of cylinder head gasket are fitted depending on the piston projection. When renewing gasket, install new gasket with same identification.
- ☐ Take note of number of holes next to parts number





18 - 20 Nm

19 - Bracket

20 - Coolant temperature sender -G62-

- ☐ Fitting location is described in guided fault finding in vehicle diagnosis tester.

21 - Seal

- ☐ Renew.

22 - Plug

23 - Sealing cover

- ☐ Renew.

24 - Cylinder head

- ☐ Removing and installing ⇒ [page 42](#)

25 - Pipe connection

- ☐ Drive pipe connection in until stop
- ☐ Renew. ⇒ [page 36](#) .

26 - Lifting eye

27 - 20 Nm

1.1.1 Checking cylinder head for distortion

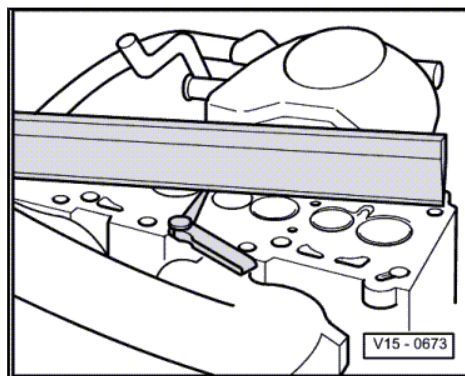
Checking cylinder head for distortion

Max. permissible distortion: 0.1 mm.



Note

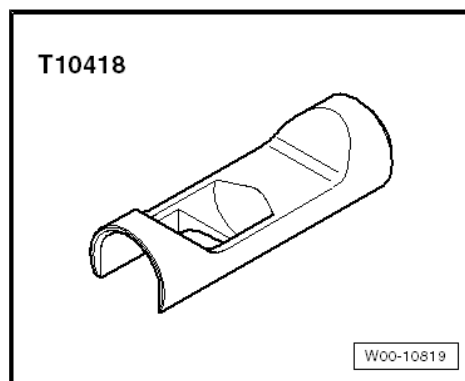
Reworking diesel cylinder heads is not permissible.



1.2 Renewing pipe connection for coolant

Special tools and workshop equipment required

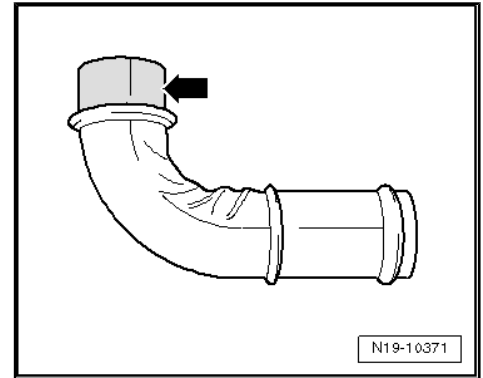
- ◆ Thrust piece -T10418-



- Drain coolant ⇒ [page 72](#) .
- Remove coolant line from pipe connection.
- Remove right heat shield from exhaust manifold.
- Remove pipe connection.
- Clean connection hole in cylinder head.



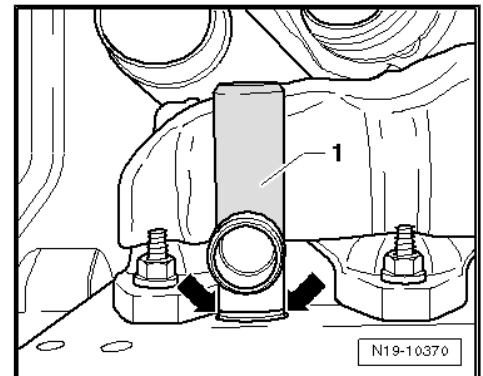
Clean area -arrow- of new pipe connection and apply sealant to the area as per ⇒ Electronic parts catalogue (ETKA) .



- Drive pipe connection into connection hole in cylinder head as far as stop -arrows- using thrust piece -T10418- -1-.

Further installation is performed in the reverse sequence.

- Fill coolant system with coolant ⇒ [page 72](#) .



1.3 Removing and installing camshaft drive gear

Special tools and workshop equipment required

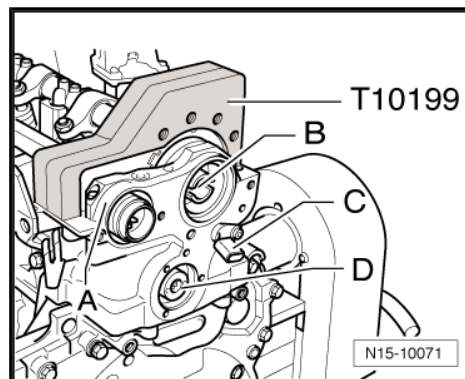
- ◆ Allen key, long reach -T10198-
- ◆ Clamp -T10199-
- ◆ Thrust piece -T10199/1-
- ◆ Wrench -T10211-
- ◆ Insert tool -T10234-
- ◆ Torque wrench -V.A.G 1331- (5...50 Nm)
- ◆ Torque wrench -V.A.G 1332- (40...200 Nm)
- ◆ Torque wrench 50-100 Ncm -VAS 6253-

1.3.1 Removing

- Position crankshaft at TDC for cylinder No. 1 ⇒ [page 41](#) .
- Remove charge air pipes between charge air cooler and turbocharger and between charge air cooler and intake connecting flange.
- Remove intake manifold support.
- Remove exhaust gas recirculation connecting pipe.
- Remove engine cover and cylinder head cover
⇒ [Item 4 \(page 35\)](#) .
- Remove tandem pump ⇒ [page 107](#) .
- Disconnect central connector for unit injectors.
- Release central connector on cylinder head side. Turn it anti-clockwise using wrench -T10211-



- Remove outer bearing cap -A-, set clamp -T10199- on camshaft gear and tighten its bolts to 40 Nm.
- Loosen securing bolt -B- of camshaft gear using socket -T10198- and remove it along with drive for tandem pump.
- Remove camshaft position Hall sender - G40- -C-.
- Remove the camshaft sprocket and the disc behind it (diamond-coated) from the camshaft.
- Unbolt sealing cover from eccentric pin.
- Remove securing bolt -D- and pull eccentric pin out.
- Carefully remove camshaft compensating gear together with adjustment plate.



1.3.2 Installing

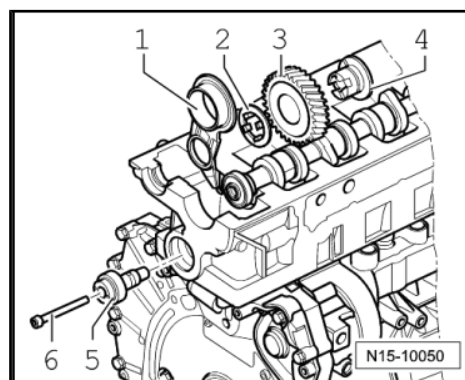
- Oil all surfaces of guide sleeve -4- and adjustment plate -1-.
- Place camshaft compensating gear -3- onto guide sleeve.
- Install disc -2- as shown.



Note

The lugs of the disc must engage in the grooves of the guide sleeve

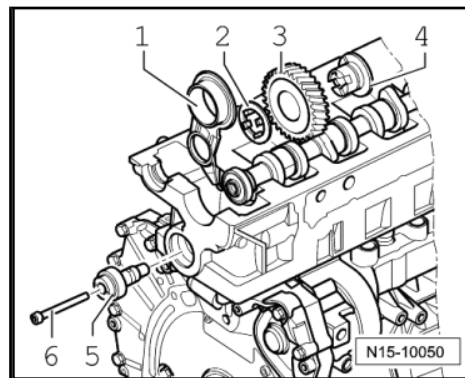
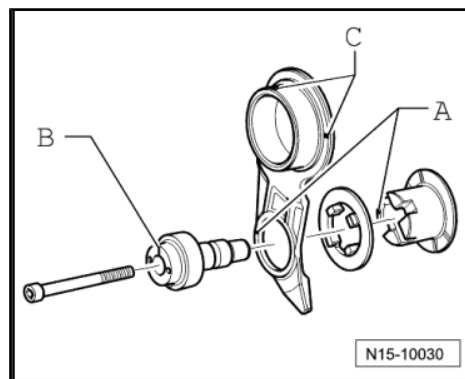
- Place compensating gear with disc and guide sleeve onto adjustment plate -1-.



Note

The marks -A- of the guide sleeve and the adjustment plate must align.

- Carefully insert adjustment plate with camshaft compensating gear from above into respective cavity.
- Oil all surfaces of eccentric pin -5-.



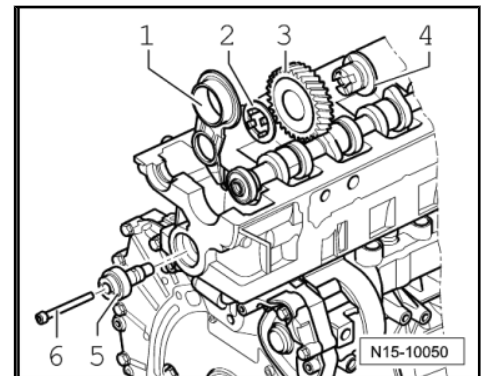
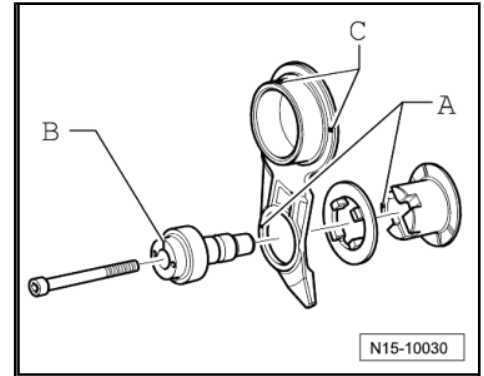


- Install eccentric pin. The marking -B- on the eccentric pin must be vertical and uppermost.

i Note

Marking -C- must align with sealing surface of cylinder head.

- Install outer bearing cap and tighten hand tight.
- Install new securing bolt -6- for eccentric pin and tighten by hand until approx. one turn before stop.
- Fit insert tool -T10234- with torque wrench -VAS 6253- into holes of eccentric pin.

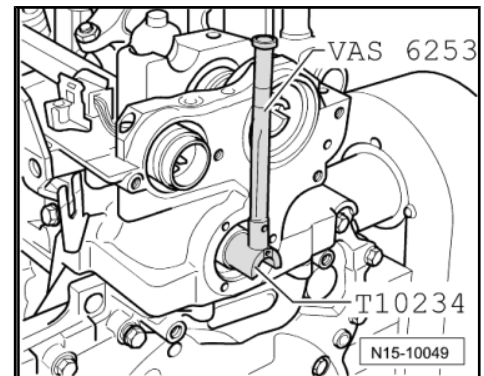


- Turn eccentric pin carefully anti-clockwise with 50 Ncm (0.5 Nm).
- Hold eccentric pin in this position and tighten new eccentric securing bolt.

Specified torque: 20 Nm + turn (90°) further

- Remove outer bearing cap again.
- Place central connector of unit injectors carefully into cylinder head.
- Install outer bearing cap with sealant and tighten using new bolts.

Specified torque: 8 Nm + turn (90°) further



i Note

Seal parting surfaces of outer bearing caps with sealant according to ⇒ Electronic parts catalogue (ETKA) ⇒ [page 50](#).

- Lock central connector of unit injectors on cylinder head side. Turn it clockwise onto limit stop using wrench -T10211-.
- Tighten eccentric pin sealing cover and Hall sender -G40-.

Specified torque: 10 Nm

i Note

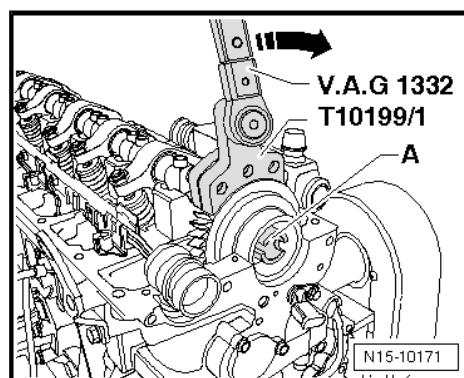
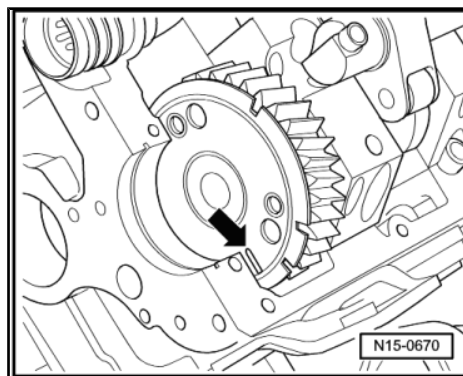
- ♦ Check that the disc (diamond-coated) is seated correctly on the camshaft before installing the camshaft gear wheel.
- ♦ The teeth of the gear wheel must be oiled completely.



- Seat camshaft gear wheel with new disc (diamond-coated) onto camshaft so that the marking -arrow- on the sender wheel aligns with the upper edge of the cylinder head sealing surface.
- Secure camshaft gear wheel and tandem pump drive using new bolt and tighten hand-tight. (Camshaft gear wheel can still turn).
- Fit clamping device -T10199/1- as shown and tighten its clamping bolts to 70 Nm.
- Insert torque wrench -V.A.G 1332- into square end of clamp, and push with 80 Nm against direction of engine rotation.

To eliminate gear drive backlash:

- Maintain this force and tighten camshaft gear wheel securing bolts to 50 Nm using socket -T10198- .
- Remove clamp -T10199/1- .



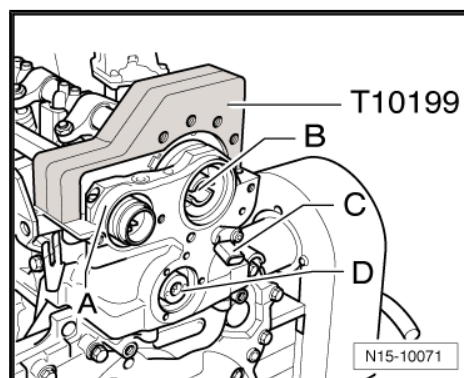
- Fit clamp -T10199- onto camshaft gear wheel.



Note

Ensure the clamp -T10199- lies flush with the cylinder head.

- Tighten bolts for clamp - T10199- to 40 Nm.
- Then secure camshaft gear wheel with clamp -T10198- .
Specified torque: 150 Nm + turn (90°) further.
- Remove clamp -T10199- .
- Remove locking devices from camshaft and crankshaft.
- Install tandem pump ⇒ [page 107](#) .
- Install cylinder head cover and engine cover
⇒ [Item 4 \(page 35\)](#) .
- Turn crankshaft 2 rotations in engine direction of rotation until crankshaft is set to TDC No. 1 cylinder again.
- Check that the camshaft clamp as well as the crankshaft clamp can be inserted.
- Install new camshaft sealing cover.
- Install new crankshaft sealing cover.
- Install charge air pipes between charge air cooler and turbo-charger and between charge air cooler and intake connecting flange.
- Install intake manifold support.
- Install exhaust gas recirculation connecting pipe.





1.4 Setting engine to TDC No. 1 cylinder

Special tools and workshop equipment required

- ◆ Camshaft clamp -T10193-
- ◆ Crankshaft clamp -T10226-
- ◆ Special wrench -T10225-
- ◆ Lever -VW 681-
- ◆ Puller hooks -10-221-
- ◆ Torque wrench -V.A.G 1331- (5...50 Nm)

1.4.1 Procedure

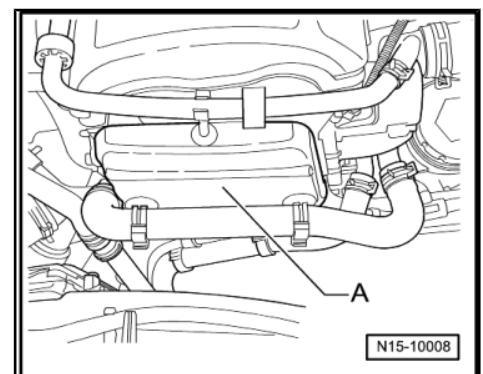
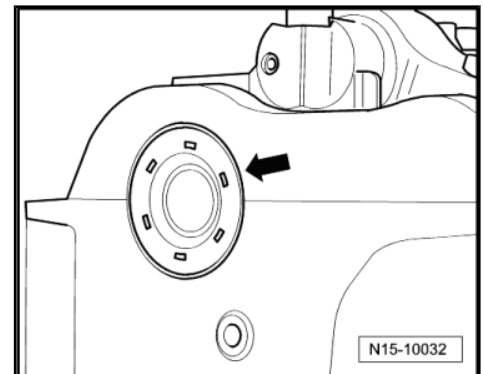
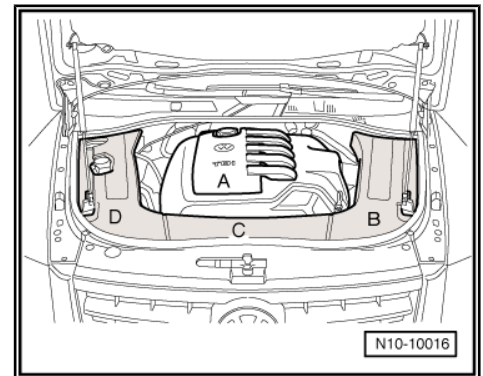
With engine installed

- If fitted, remove engine cover -A- and engine compartment covers -B-, -C- and -D-.
- Remove noise insulation.

Continuation with engine removed or in situ

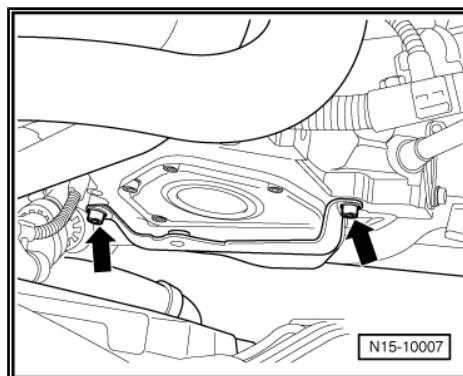
- Lever camshaft cover -arrow- out using lever -VW 681- .

- Remove noise insulation from end of engine block.





- Unscrew bolts -arrows- and remove retainer for noise insulation.
- Lever sealing cover out of sealing flange on end of block using lever -V.A.G 10-221- .



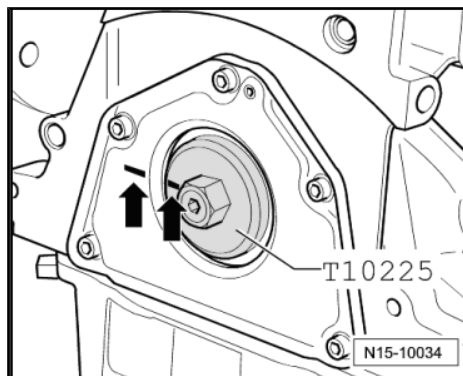
- Bolt special wrench -T10225- onto crankshaft.



Note

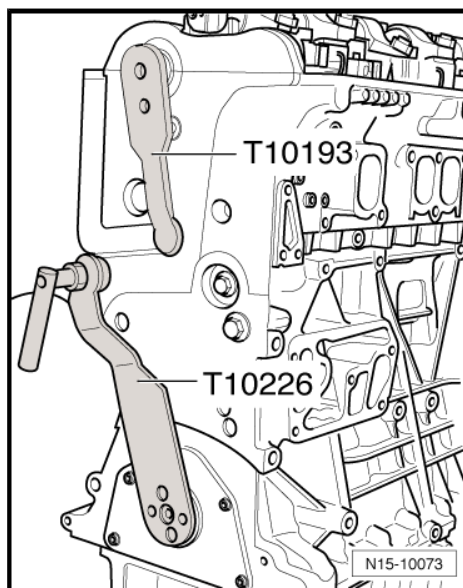
It is only possible to bolt special wrench -T10225- onto crankshaft in one position. To do this, turn screw into crankshaft through centre of tool and tighten to 20 Nm.

- Turn the crankshaft in engine direction of rotation until marks -arrows- on special wrench - T10225- and sealing flange align.
- Unbolt special wrench -T10225- from crankshaft.
- Secure crankshaft with crankshaft clamp -T10226- as shown. At the same time the crankshaft locking piece must engage in the cylinder block.
- Bolt crankshaft clamp -T10226- onto crankshaft.



Note

- ♦ *It is only possible to bolt crankshaft clamp -T10226- onto crankshaft in one position.*
- ♦ *If crankshaft clamp -T10226- cannot be bolted to crankshaft, crankshaft is at exhaust stroke TDC and not at at ignition TDC.*
- ♦ *In this case, turn crankshaft in engine direction of rotation until marks on special wrench and sealing flange align again.*
- Fit camshaft clamp -T10193- .
- Check position of camshaft gear wheel ➔ [page 37](#) , Removing and installing camshaft drive gear.



1.5 Removing and installing cylinder head

Special tools and workshop equipment required

- ♦ Torque wrench -V.A.G 1331- (5 ... 50 Nm)
- ♦ Torque wrench -V.A.G 1332- (40 ... 200 Nm)

1.5.1 Removing

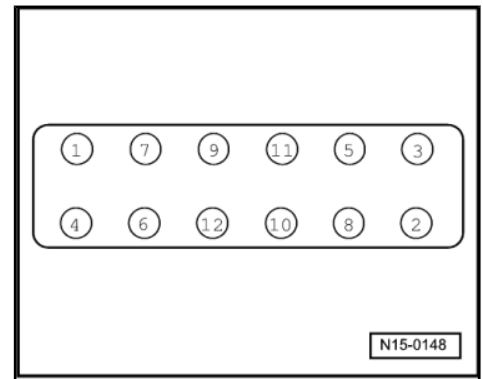


Note

The removal and installation of the cylinder head can only be undertaken when the engine is removed due to the cramped conditions.



- Remove engine and gearbox ⇒ [page 5](#) .
- Remove intake manifold support.
- Remove exhaust gas recirculation connecting pipe.
- Remove engine cover and cylinder head cover
⇒ [Item 4 \(page 35\)](#) .
- Remove tandem pump ⇒ [page 107](#) .
- Unscrew turbocharger/exhaust manifold securing bolts
⇒ [page 110](#) .
- Disconnect all necessary coolant and vacuum hoses as well
as electrical connections on cylinder head.
- Position crankshaft at TDC for cylinder No. 1 ⇒ [page 41](#) .
- Remove camshaft gear wheel ⇒ [page 37](#) .
- Unscrew threaded connection for cylinder head control hous-
ing ⇒ [Item 18 \(page 35\)](#) .
- Maintain sequence when loosening and tightening cylinder
head bolts.



1.5.2 Installing



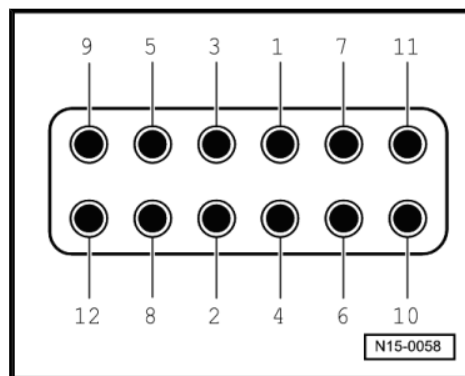
Note

- ◆ *Different thicknesses of cylinder head gasket are fitted de-
pending on the piston projection. When renewing gasket,
install new gasket with same identification.*
- ◆ *Take note of number of holes next to part number.*
- ◆ *Always renew cylinder head bolts.*
- ◆ *In cases of repair carefully remove gasket remains from cyl-
inder head and cylinder block. Ensure that no long scores or
scratches are made on the surfaces. When using abrasive
paper do not use a grade less than 100.*
- ◆ *Carefully remove emery and abrasive remains.*
- ◆ *Do not remove new cylinder head gasket from packaging until
it is ready to be fitted.*
- ◆ *Handle gasket very carefully. Damage to the elastomeric coat-
ing or the indented area will lead to leaks.*
- ◆ *Use new gasket with same identification (index).*
- Position crankshaft (turn in engine direction of rotation) at TDC
for No. 1 cylinder and secure with clamp -T101226- .



Note

- ◆ *To prevent valves from contacting pistons when installing:*
- ◆ *Always ensure that camshaft is positioned as accurate as possible at TDC for No. 1 cylinder.*
- Position cylinder head gasket.
- Fit cylinder head, install cylinder head bolts and tighten hand tight.
- Tighten cylinder head in 6 stages in sequence shown as follows:
- Tighten initially with torque wrench:
Stage I = 60 Nm
- Turn further with rigid spanner:
Stage II = $\frac{1}{4}$ turn (90°)
Stage III = $\frac{1}{4}$ turn (90°)
Stage IV = $\frac{1}{4}$ turn (90°)
Stage V = $\frac{1}{4}$ turn (90°)
- Turning back with rigid spanner:
Stage VI = loosen all cylinder head bolts $\frac{1}{4}$ turn (90°).
- Tighten threaded connection between cylinder head/control housing ⇒ [Item 18 \(page 35\)](#) to 20 Nm.
- Install camshaft drive gear wheel ⇒ [page 37](#) .
- Install turbocharger ⇒ [page 110](#) .
- Install exhaust gas recirculation connecting pipe.
- Install intake manifold support.
- Install cylinder head cover and engine cover
⇒ [Item 4 \(page 35\)](#) .
- Install engine and gearbox ⇒ [page 5](#) .
- Carry out road test and read all event memories
⇒ [page 139](#) .

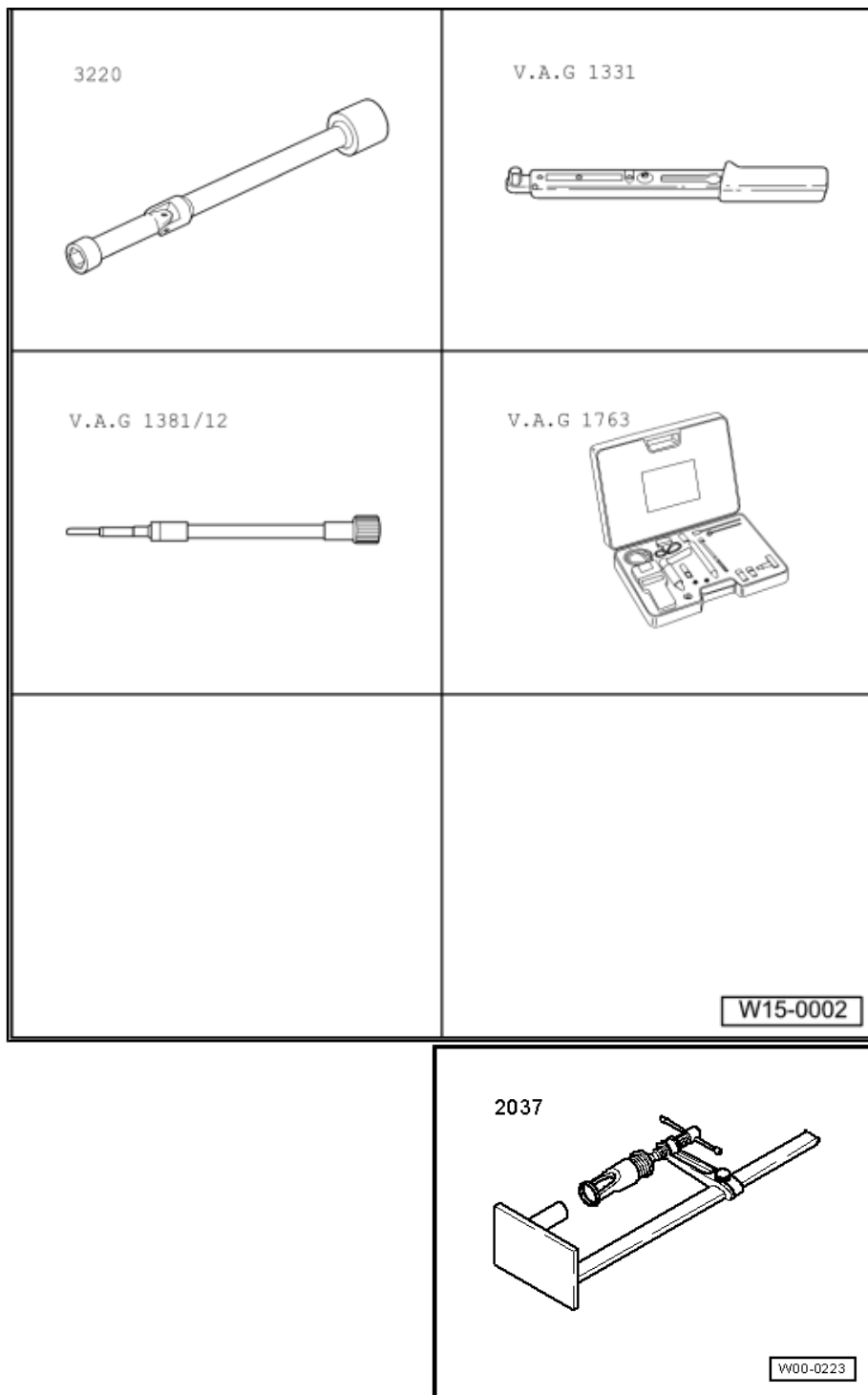




1.6 Checking compression

Special tools and workshop equipment required

- ◆ 10 mm jointed spanner -3220-
- ◆ Torque wrench - V.A.G 1331- (5 ... 50 Nm)
- ◆ Adapter -V.A.G 1381/12-
- ◆ Compression tester - V.A.G 1763-
- ◆ Removing and installing valve springs with cylinder head removed -2037-



Test prerequisite

- Engine oil temperature min. 30 °C.

Test procedure

- Disconnect central connector on cylinder head for unit injectors.
- Remove all glow plugs using 10 mm jointed wrench -3220- .



- Screw in adapter -V.A.G 1381/12- in place of the glow plugs.
- Check compression using compression tester -V.A.G 1763- .



Note

Using compression tester ⇒ operating instructions .

- Operate starter until tester shows no further pressure increase.

Compression pressures:

New: 25 ... 31 bar, wear limit: 19 bar

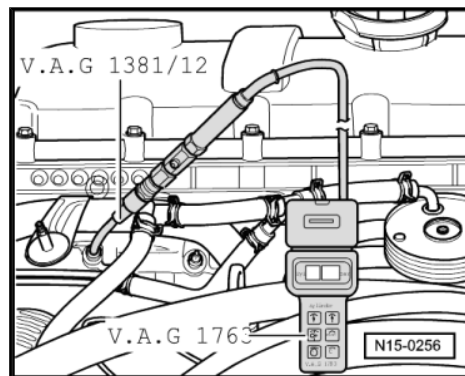
Maximum permissible difference between all cylinders: 5 bar

- Install glow plugs using U/J extension and socket, 10 mm -3220- . Specified torque: 15 Nm.
- Read event memory ⇒ [page 139](#) .



Note

Disconnecting the central connector for unit injectors causes faults to be stored. Therefore, read event memory and delete if necessary ⇒ [page 139](#) .





2 Repairing valve gear



Note

Cylinder heads with cracks between the valve seats may be used without reducing engine life, provided the cracks are small and not more than 0.5 mm wide.

⇒ [„2.1 Assembly overview - valve gear“, page 47](#)

⇒ [„2.2 Reworking valve seats“, page 51](#)

⇒ [„2.3 Checking valve guides“, page 53](#)

⇒ [„2.4 Renewing valve stem seals“, page 53](#)

⇒ [„2.5 Removing and installing camshaft“, page 55](#)

2.1 Assembly overview - valve gear

⇒ [„2.1.1 Checking camshaft axial clearance“, page 50](#)

⇒ [„2.1.2 Sealing parting surfaces of bearing caps“, page 50](#)

⇒ [„2.1.3 Valves“, page 50](#)

⇒ [„2.1.4 Camshaft identification, valve timing“, page 51](#)



1 - 8 Nm + 90° further

- ☐ Renew.

2 - 20 Nm + 90° further

- ☐ Renew.
- ☐ Note sequence when loosening and tightening ➔ [page 55](#) , Removing and installing camshaft.

3 - Rocker arm shaft

- ☐ Do not interchange.

4 - Bucket tappet

- ☐ Do not interchange.
- ☐ With hydraulic valve clearance compensation.
- ☐ Set down with contact surface facing downwards.
- ☐ Before installing, check camshaft axial clearance ➔ [page 50](#) .
- ☐ Oil running surface.

5 - Cotters

6 - Valve spring plate

7 - Outer valve spring

- ☐ Installing and removing: cylinder head removed: with Removing and installing valve springs with cylinder head removed -2037- . Cylinder head installed: ➔ [page 53](#) , Renewing valve stem oil seals

8 - Inner valve spring

- ☐ Installing and removing: cylinder head removed: with Removing and installing valve springs with cylinder head removed -2037- . Cylinder head installed: ➔ [page 53](#) , Renewing valve stem oil seals

9 - Valve stem seal

- ☐ Renew. ➔ [page 53](#) .

10 - Washer

- ☐ For cylinder head bolts.
- ☐ Insert in cylinder head before installing bearing caps

11 - Valves

- ☐ Valve dimensions ➔ [page 50](#)

12 - Unit injector

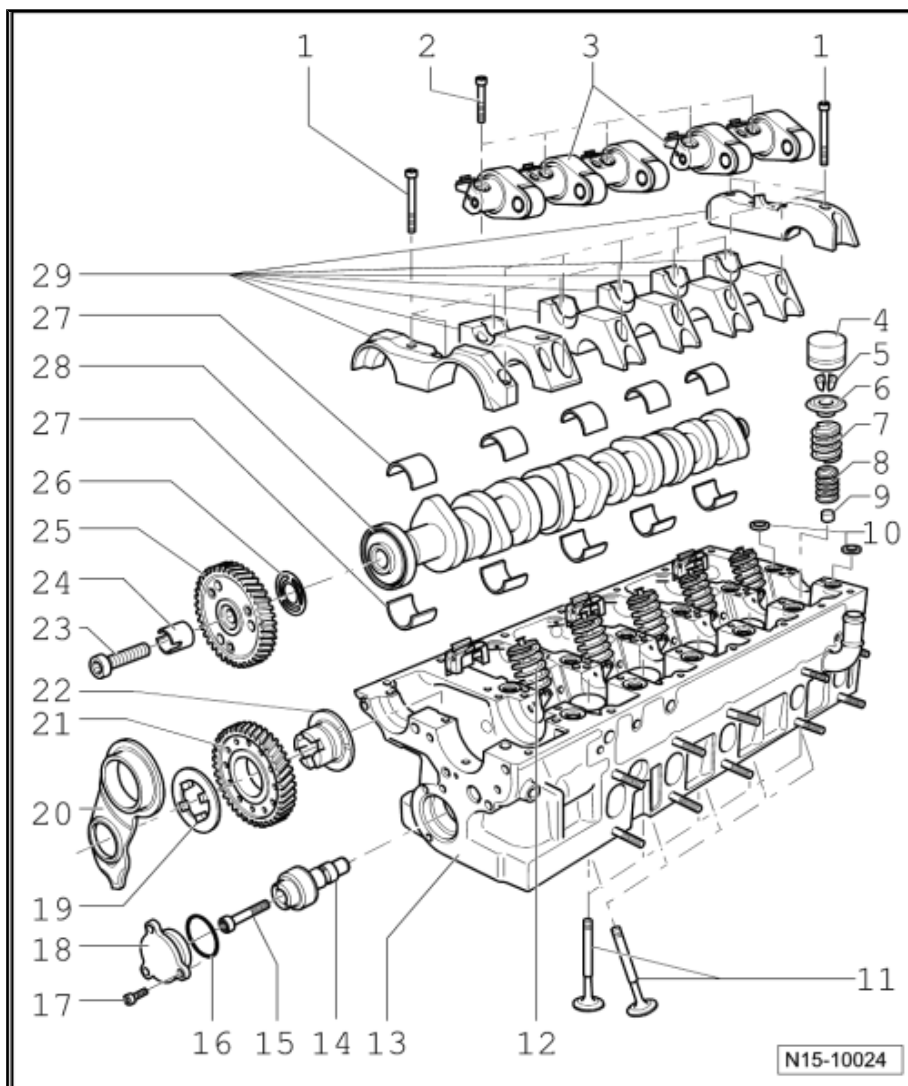
- ☐ Removing and installing ➔ [page 128](#)

13 - Cylinder head

- ☐ See note ➔ [page 47](#) .
- ☐ Reworking valve seats ➔ [page 51](#) .
- ☐ Removing and installing ➔ [page 42](#)

14 - Eccentric pin

- ☐ Oil when installing.





- ☐ Note installation position ⇒ [page 37](#) , Removing and installing camshaft drive gear.

15 - 20 Nm + 90° further

- ☐ Renew.

16 - O-ring

- ☐ Renew.

17 - 10 Nm

18 - Cap

19 - Washer

20 - Adjustment plate

21 - Compensating gear

- ☐ For camshaft.
- ☐ Removing and installing ⇒ [page 37](#)

22 - Guide sleeve

- ☐ Oil when installing.
- ☐ Note installation position ⇒ [page 37](#) , Removing and installing camshaft drive gear.

23 - 150 Nm + 90° further

- ☐ Renew.

24 - Tandem pump drive

- ☐ Removing and installing tandem pump ⇒ [page 107](#) .

25 - Camshaft pulley

- ☐ With camshaft position sender wheel.
- ☐ Oil when installing.
- ☐ Note installation position ⇒ [page 37](#) , Removing and installing camshaft drive gear.

26 - Washer

- ☐ Renew.

27 - Bearing shell

- ☐ Do not interchange used bearing shells (mark).
- ☐ Ensure that retaining lugs are correctly seated in bearing caps and cylinder head

28 - Camshaft

- ☐ Checking axial clearance ⇒ [page 50](#) .
- ☐ Removing and installing ⇒ [page 55](#)
- ☐ Check radial clearance with Plastigage; wear limit: 0.11 mm.
- ☐ Runout: max. 0.01 mm.
- ☐ Identification and valve timing ⇒ [page 51](#) .

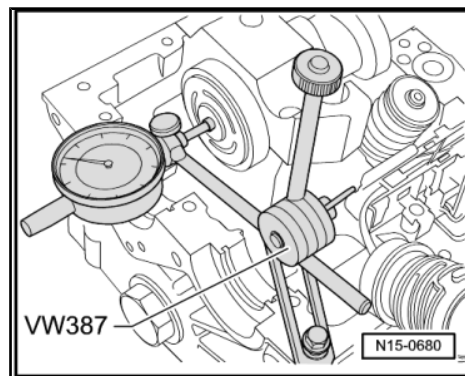
29 - Bearing cap

- ☐ When installing, seal parting surfaces of outer bearing caps with sealant according to ⇒ Electronic parts catalogue (ETKA) ⇒ [page 50](#) .



2.1.1 Checking camshaft axial clearance

Checking camshaft axial clearance



Special tools and workshop equipment required

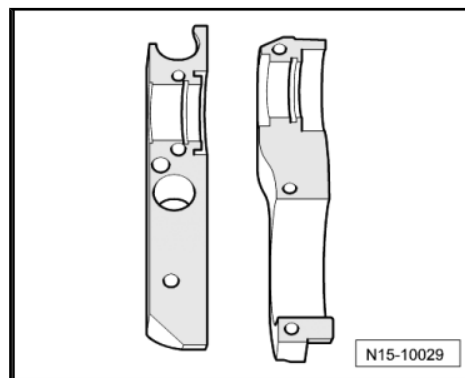
- ◆ Universal dial gauge bracket -VW 387-
- ◆ Dial gauge

Check with bucket tappets removed and with 2, 4 and 6 bearing caps fitted.

Wear limit: max. 0.15 mm

2.1.2 Sealing parting surfaces of bearing caps

Seal parting surfaces of bearing caps 1 and 7 with sealant.



Special tools and workshop equipment required

- ◆ Sealant as per ⇒ Electronic parts catalogue (ETKA) .
- Apply sealant as per ⇒ Electronic parts catalogue (ETKA)
thinly and evenly on surfaces.

2.1.3 Valves

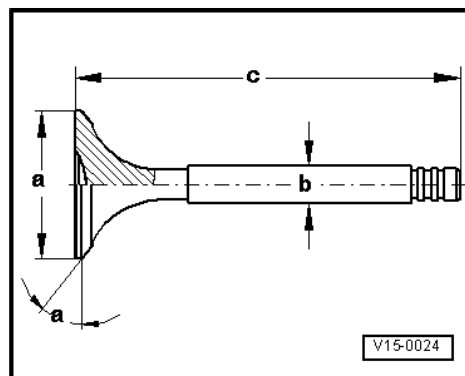
Valve dimensions



Note

Valves must not be reworked. Only lapping-in is permitted.

Dimension		Inlet valve	Exhaust valve
Ø a	mm	35.95	31.45
Ø b	mm	6.980	6.956
c	mm	89.95	89.95
α	°	45	45





2.1.4 Camshaft identification, valve timing

Camshaft identification, valve timing

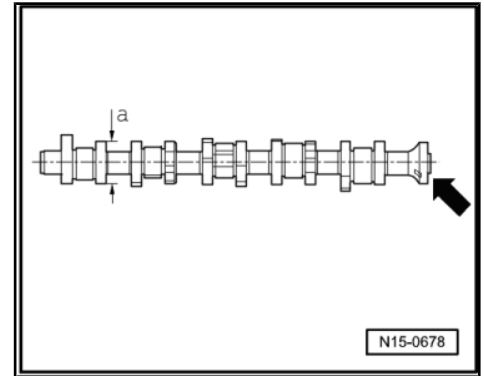
Identification

- ◆ Cam base diameter: $a = 52.8 \text{ mm } \varnothing$.
- ◆ Identification by stamped numbers and letters on drive-end face of camshaft.

Drive end -arrow-	070 M
-------------------	-------

Valve timing at 1 mm valve lift

Inlet opens ATDC	12°
Inlet closes ABDC	21.5°
Exhaust opens BBDC	30°
Exhaust closes BTDC	20.5°



2.2 Reworking valve seats

Special tools and workshop equipment required

- ◆ Depth gauge
- ◆ Valve seat refacing tool



Note

- ◆ *When repairing engines with leaking valves, it is not sufficient to rework or renew valve seats and valves. There is also a requirement to check the valve guides for wear. This is particularly important on high mileage engines.*
- ◆ *Valve seats are only to be reworked to the extent required to yield a proper surface appearance. Before beginning to rework valve seats, calculate the maximum permissible reworking dimensions. If the reworking dimension is exceeded, the hydraulic valve clearance compensation can no longer be guaranteed and the cylinder head must be renewed.*

The max. permissible reworking dimension is calculated as follows:

- Insert valve and press firmly against seat.



Note

If the valve is to be renewed as part of a repair, use a new valve for the calculation.



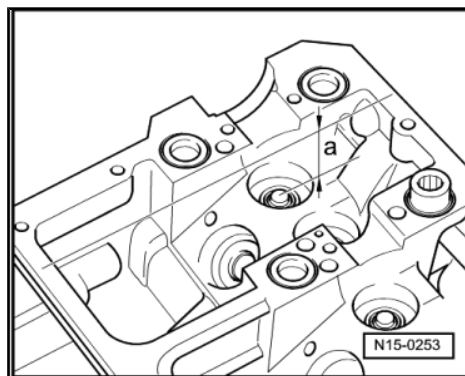
- Measure distance -a- between end of valve stem and upper edge of cylinder head.
- Calculate maximum permissible reworking dimension from measured distance -a- and minimum dimension.

Minimum dimension:

Inlet valve 43.4 mm

Exhaust valve 43.2 mm

Measured distance minus minimum dimension = max. permissible reworking dimension.



Example:

	Measured distance	44.1 mm
-	Minimum dimension	43.4 mm
=	Max. permissible reworking dimension	0.7 mm

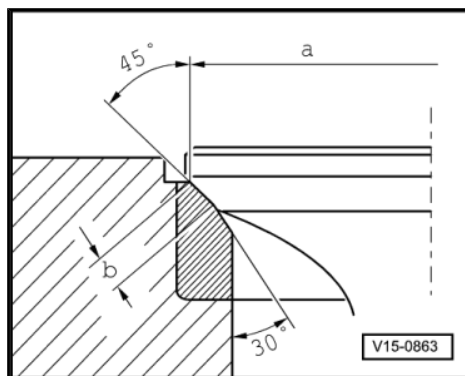
Reworking inlet valve seat.

- a = $\varnothing$ 35.7 mm
b = 1.6 mm
45° = Valve seat angle

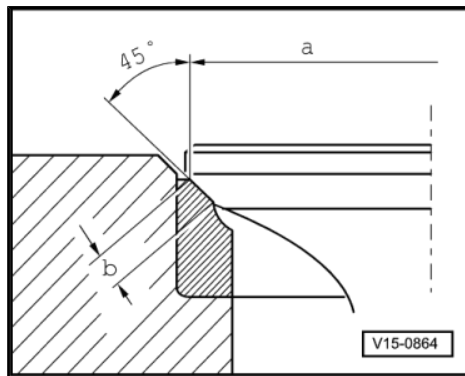


Note

The 30° lower valve seat chamfer is necessary to ensure that the inlet channel flow characteristics are maintained.



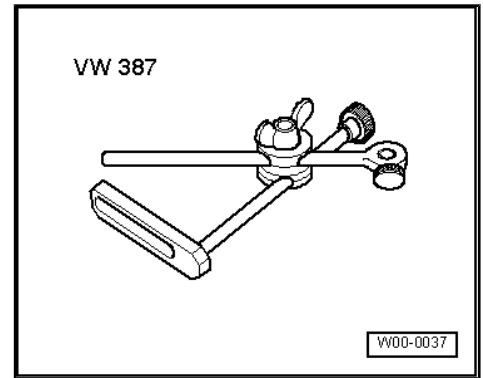
Reworking exhaust valve seat.



- a = $\varnothing$ 31.4 mm
b = 2.7 mm
45° = Valve seat angle



2.3 Checking valve guides

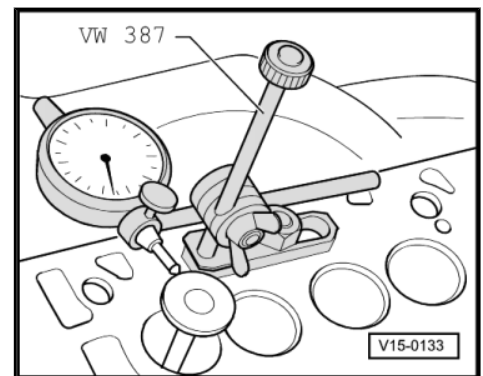


Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-
- ◆ Dial gauge

Test procedure

- Insert new valve into guide. The end of the valve stem must be flush with the guide. On account of differing stem diameters, only use inlet valve in inlet guide and exhaust valve in exhaust guide.
- Max. rock: 1.3 mm.
- Cylinder head must be renewed if rock exceeds wear limit.



2.4 Renewing valve stem seals

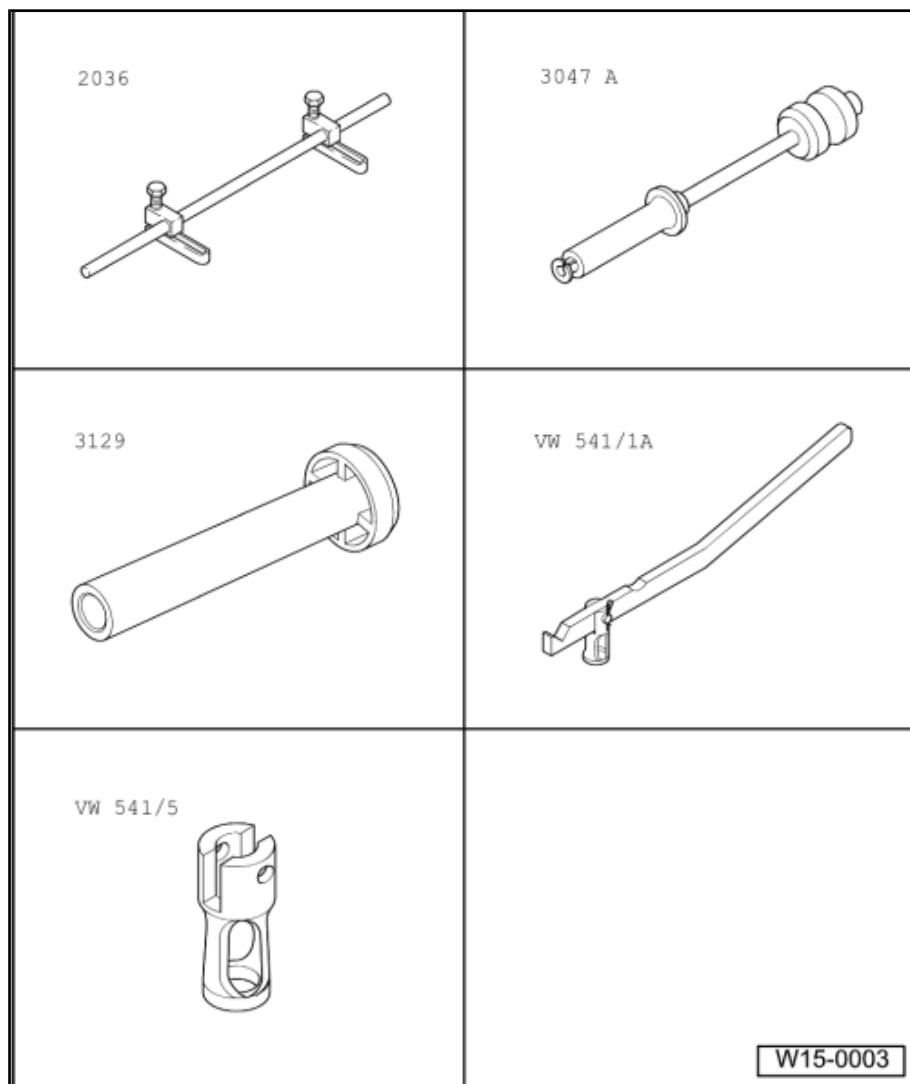
⇒ „2.4.1 Removing“, page 54

⇒ „2.4.2 Installing“, page 55



Special tools and workshop equipment required

- ◆ Valve assembly device -2036-
- ◆ Puller -3047A-
- ◆ Fitting tool -3129-
- ◆ Valve lever -VW 541/1A-
- ◆ Thrust piece -VW 541/5-



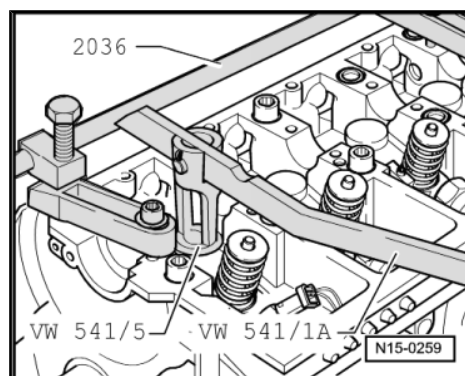
2.4.1 Removing

- Remove camshaft ➔ [page 55](#) .
- Remove bucket tappets and place them with the contact surface downwards. When doing this, ensure that the tappets are not interchanged.
- Set piston of respective cylinder to top dead centre (TDC).
- Fit valve assembly tool -2036- and adjust mountings to height of studs.
- Remove valve springs using valve lever -VW 541/1A- and press tool - VW 541/5- .



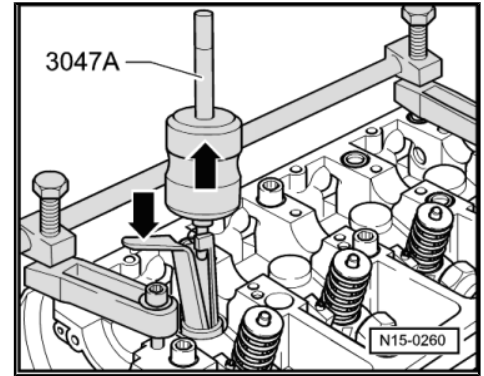
Note

The valves are supported by the piston crown.



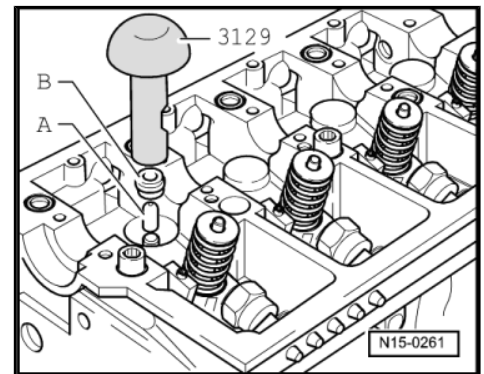


- Pull off valve stem seals using tool 3047A.



2.4.2 Installing

- Place the plastic sleeve -A- supplied on the respective valve stem. This will prevent the new valve stem seal -B- being damaged.
- Place new valve stem seal in fitting tool -3129- .
- Oil valve stem seal sealing lip and press carefully onto the valve guide.



2.5 Removing and installing camshaft

⇒ „2.5.1 Removing“, page 55

⇒ „2.5.2 Installing“, page 56

Special tools and workshop equipment required

- ◆ Torque wrench -V.A.G 1331- (5 ... 50 Nm)
- ◆ Torque wrench -V.A.G 1332- (40 ... 200 Nm)
- ◆ Sealant as per ⇒ Electronic parts catalogue (ETKA) .



Note

The removal and installation of the camshaft can only be undertaken when the engine is removed due to the cramped conditions.

2.5.1 Removing

- Remove charge air pipes between charge air cooler and turbocharger and between charge air cooler and intake connecting flange.
- Remove intake manifold support.
- Remove exhaust gas recirculation connecting pipe.
- Remove engine cover and cylinder head cover
⇒ Item 4 (page 35) .
- Remove tandem pump ⇒ page 107 .
- Remove camshaft gear wheel ⇒ page 37 .
- Remove rocker arm shafts.



- Loosen bearing caps from outer to inner, loosen bolts of last two bearing caps alternately and diagonally.

2.5.2 Installing



Note

- ♦ *Ensure that no valve is pressed against a piston during installation of the camshaft. Position pistons as uniformly as possible below TDC.*
- ♦ *Do not interchange used bearing shells (mark).*
- ♦ *When installing the camshaft, ensure proper seating of retaining lugs in bearing caps and cylinder head.*
- ♦ *Before installing bearing caps, ensure that cylinder head bolt washers are inserted in the cylinder head.*
- Oil running surfaces of shell bearings.
- Tighten inner 2 bearing caps alternately and diagonally to 8 Nm + turn (90°) further (renew).
- Install remaining bearing caps and also tighten to 8 Nm + turn (90°) further (renew).



Note

Seal parting surfaces of outer bearing caps with sealant according to ⇒ [Electronic parts catalogue \(ETKA\)](#) ⇒ [page 50](#).

- Install rocker arm shafts and tighten securing bolts, first the inner and then the outer, diagonally and evenly by hand. Then tighten, in same sequence, to 20 Nm + turn 90° further (renew).
- Install camshaft drive gear wheel ⇒ [page 37](#).
- Install tandem pump ⇒ [page 107](#).
- Install cylinder head cover and engine cover ⇒ [Item 4 \(page 35\)](#).
- Install charge air pipes between charge air cooler and turbo-charger and between charge air cooler and intake connecting flange.
- Install intake manifold support.
- Install exhaust gas recirculation connecting pipe.



Note

When new bucket tappets have been installed the engine must not be started for about 30 minutes. Hydraulic compensation elements must settle (otherwise valves will strike pistons).



17 – Lubrication

1 Engine oil



Note

The oil level must not be above the max. mark! Risk of catalytic converter damage! Markings ➔ [page 57](#) .

Engine oil specification ➔ Maintenance ; Booklet 17.1

➔ „1.1 Oil capacities“, [page 57](#)

➔ „1.2 Checking engine oil level“, [page 57](#) .

1.1 Oil capacities

With oil filter, 8.9 l

Without oil filter 8.5 l

1.2 Checking engine oil level

Markings on oil dipstick

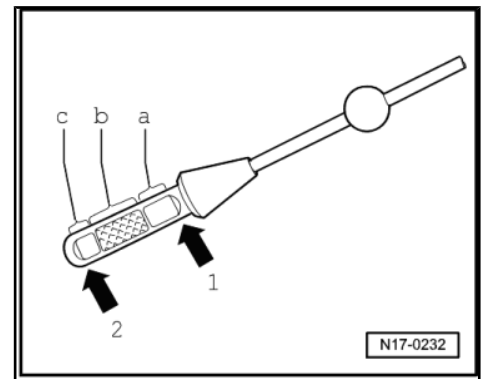
1 - Max. mark

2 - min. mark

a - Area above hatched field up to max. mark: Do not top up with engine oil!

b - Oil level within hatched field: Can be topped up with engine oil.

c - Area from min. mark up to hatched field: Must be topped up, max. 0.5 l of engine oil!





2 Parts of lubrication system

⇒ „2.1 Assembly overview - oil pump, sump“, page 58

⇒ „2.2 Assembly overview - oil filter housing“, page 59

⇒ „2.3 Removing and installing oil sump“, page 62

⇒ „2.4 Checking oil pressure and oil pressure switch“, page 65

2.1 Assembly overview - oil pump, sump

Part II: Dismantling oil filter housing ⇒ page 59

1 - 20 Nm

- ☐ The oil level must not be above the max. mark!
- ☐ Markings ⇒ page 57 .

2 - Oil dipstick

3 - Guide tube

4 - Cap

5 - Seal

- ☐ Renew if damaged.

6 - Rubber grommet

- ☐ Renew if damaged.

7 - Oil filler tube

8 - 10 Nm

9 - Seal

10 - Oil spray jet

- ☐ For piston cooling.

11 - 25 Nm

- ☐ Insert without sealant.

12 - Dowel sleeves

13 - Oil pump

- ☐ Before installing, check that both dowel sleeves for centring oil pump on cylinder block are fitted.

14 - Gasket

- ☐ Renew.

15 - Suction line

- ☐ Clean strainer if soiled.

16 - Oil sump

- ☐ Clean sealing surface before fitting.
- ☐ Install with sealant according to ⇒ Electronic parts catalogue (ETKA) ⇒ page 62 .

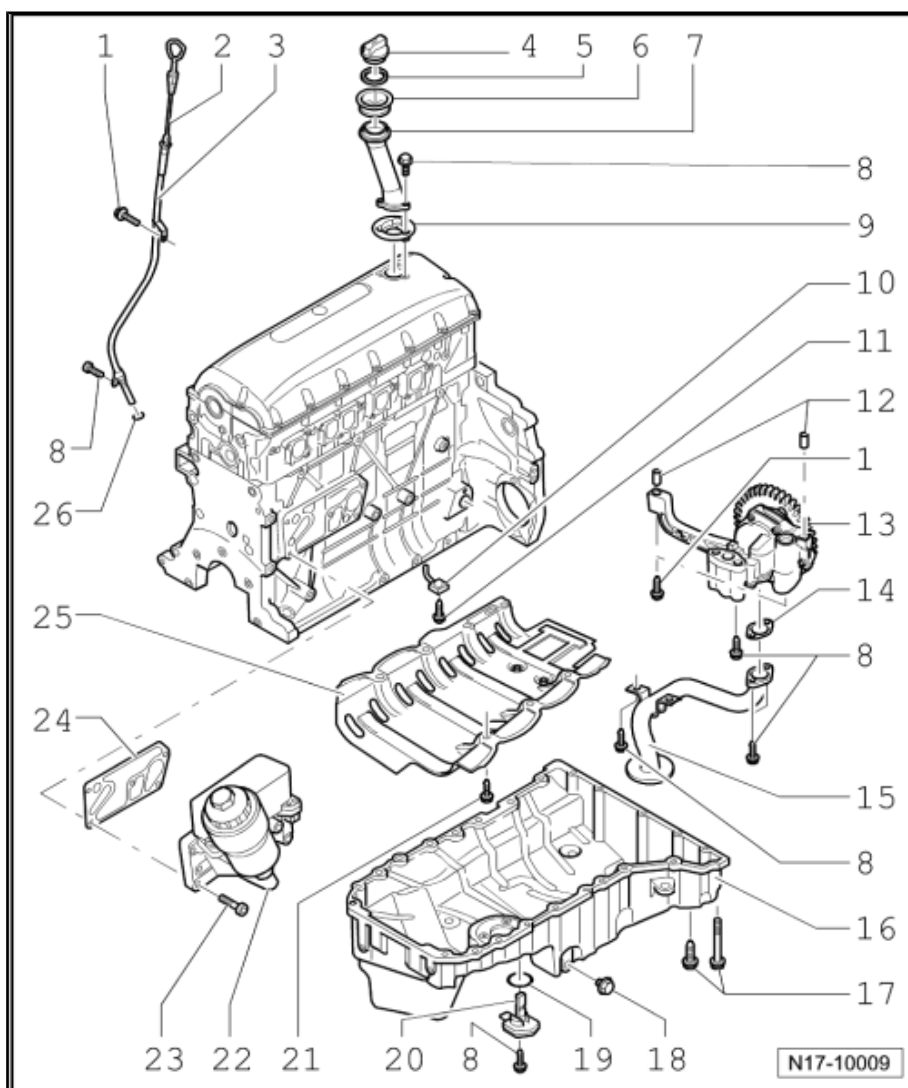
17 - 15 Nm

18 - Oil drain plug, 30 Nm

- ☐ Renew.

19 - Seal

- ☐ Renew.





20 - Oil level and oil temperature sender -G266-

- ☐ Checking ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

21 - 15 Nm

22 - Oil filter housing

- ☐ With engine oil cooler.
- ☐ Dismantling and assembling ⇒ [page 59](#) .

23 - 20 Nm

24 - Gasket

- ☐ Renew.
- ☐ Note installation position.

25 - Baffle plate

26 - O-ring

- ☐ Renew.

2.2 Assembly overview - oil filter housing

1 - Engine oil cooler

- ☐ Checking for leaks
⇒ [page 83](#) .
- ☐ To remove, the air conditioner compressor must be removed ⇒ Rep. gr. 87 .

2 - 10 Nm

3 - Coolant hose

4 - Bracket

5 - 10 Nm

6 - Screw cap, 25 Nm

7 - Seal

- ☐ Renew.

8 - Oil filter

9 - O-ring

- ☐ Renew.

10 - 0.9 bar oil pressure switch -F1-, 25 Nm

- ☐ If seal is leaking, nip open and renew.
- ☐ Checking ⇒ [page 65](#) .

11 - 20 Nm

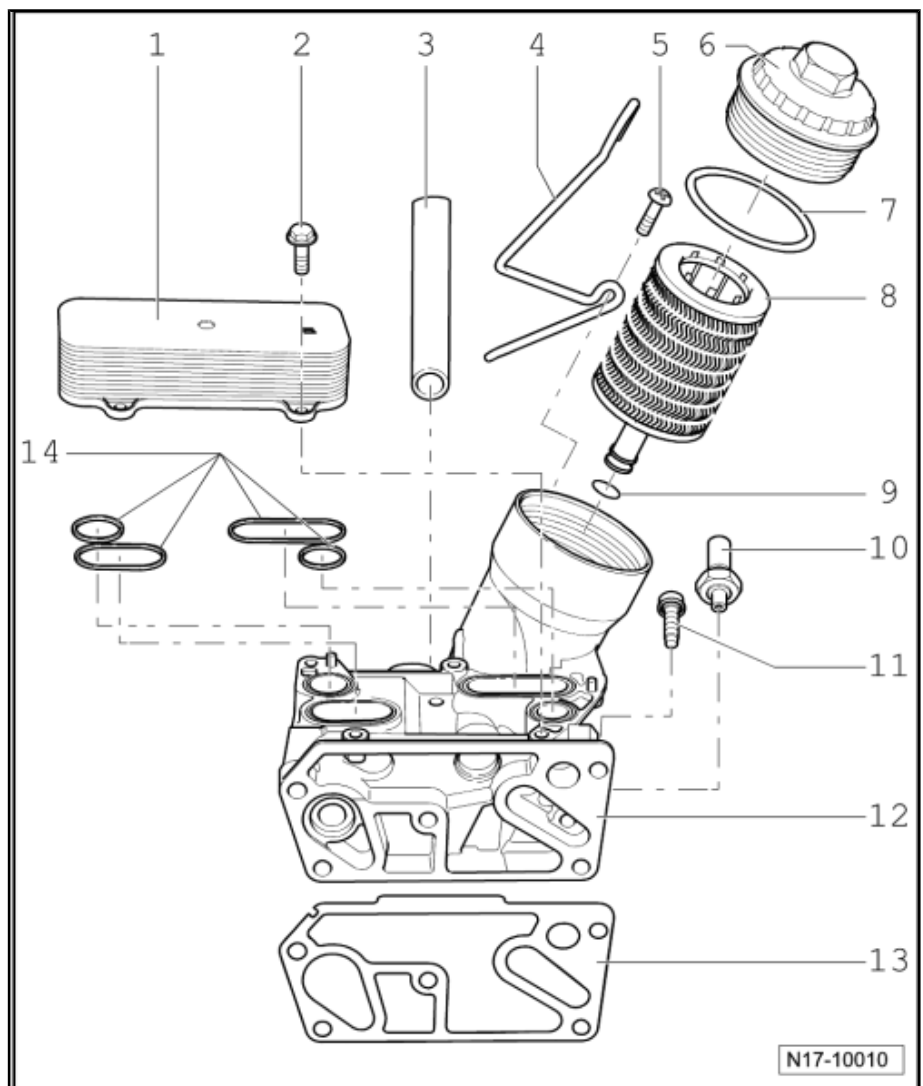
12 - Housing

13 - Gasket

- ☐ Renew.
- ☐ Note installation position.

14 - Gasket

- ☐ Renew.

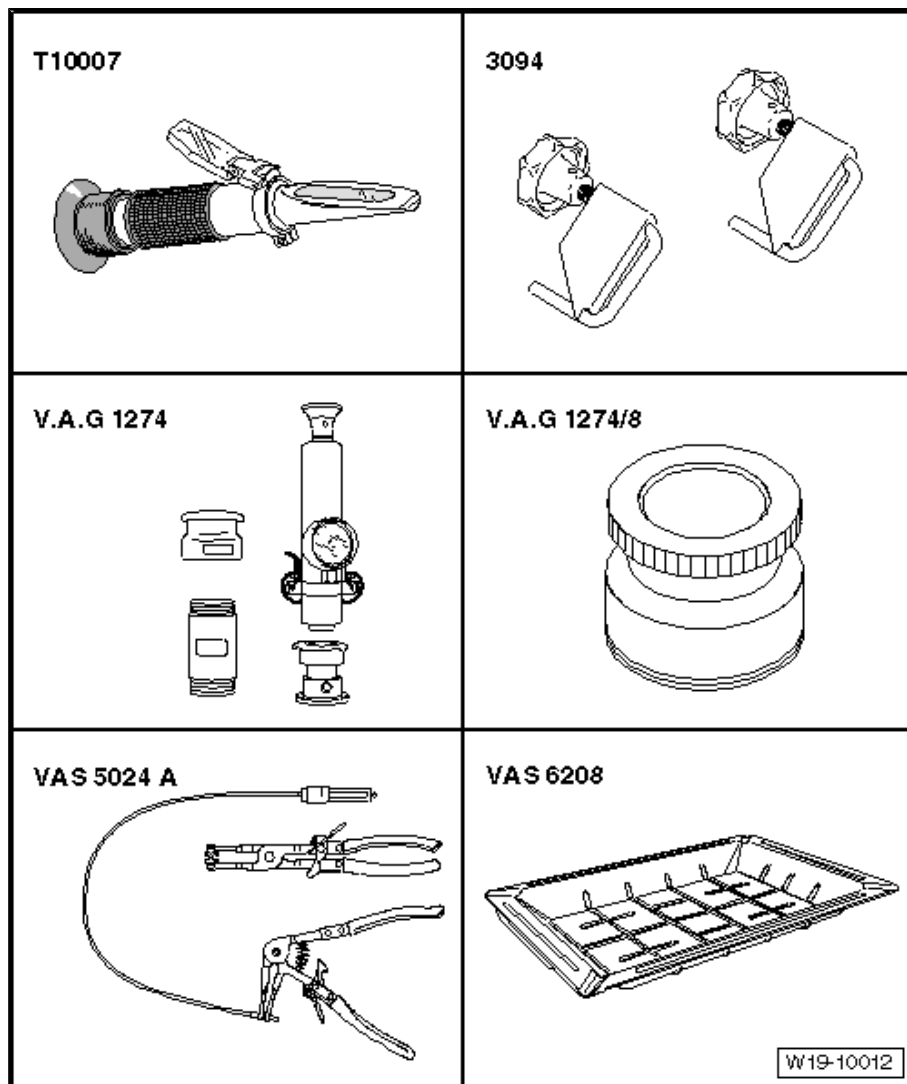




2.2.1 Removing and installing oil filter housing

Special tools and workshop equipment required

- ◆ Refractometer -T10007-
- ◆ Hose clips up to 25 mm Ø -3094-
- ◆ Cooling system tester - V.A.G 1274-
- ◆ Adapter for cooling system tester -V.A.G 1274/8-
- ◆ Spring-type clip pliers -VAS 5024 A-
- ◆ Drip tray -V.A.G 1306- or drip tray -VAS 6208-



- Disconnect battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and reconnecting battery .



Note

If oil filter is to be exchanged during repair, open oil filter cover now to ventilate oil filter housing. This prevents large amounts of engine oil to run out when removing housing.

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Noise insulation; Assembly overview - noise insulation .
- Drain coolant ⇒ [page 72](#) .
- Do not reconnect coolant hose.
- Open thermostat housing. Renew gasket before installing ⇒ [Item 9 \(page 70\)](#) .

Hose and thermostat housing need to remain open. Cooling system will therefore not subsequently be damaged when letting compressed air in.



Collect escaping coolant with drip tray -V.A.G 1306- or drip tray -VAS 6208- .

- Remove air intake hose to intake air connection
⇒ [page 123](#) .
- Clean vicinity of oil dipstick guide tube on crankcase to prevent engine oil contamination.
- Release dipstick guide tube from oil filter housing and crankcase.

Later you will remove dipstick guide tube together with air conditioner compressor.

- Remove engine wiring harness bracket from beneath intake manifold -1- (10 Nm).

All cable ties which are opened or cut open when engine cable bracket is removed must be replaced in the same position when engine is installed.

All connectors which are separated during removal of engine cable bracket must be reconnected in the original position when installing.

Unscrew air conditioner compressor from its console ⇒ Rep. gr. 87 .

Do not open refrigerant circuit. Lay air conditioner compressor to side.

- Remove dipstick guide tube.
- Seal hole.
- Remove coolant hose ⇒ [Item 3 \(page 59\)](#) from oil filter housing and clamp it off using hose clamps, up to Ø 25 mm -3094- .



WARNING

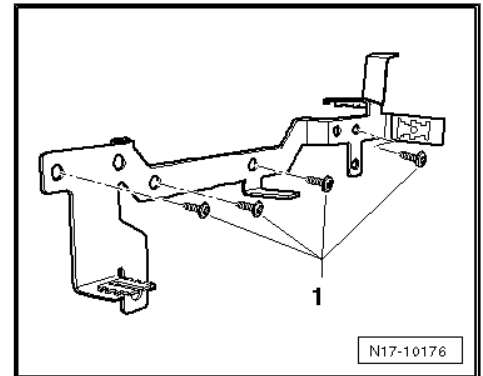
To avoid injury from coolant, wear eye protection.

- Carefully blow coolant residues around coolant connection off oil filter housing using compressed air and seal with a cloth.

Collect engine oil leaking out of oil filter housing with a cloth, if necessary.

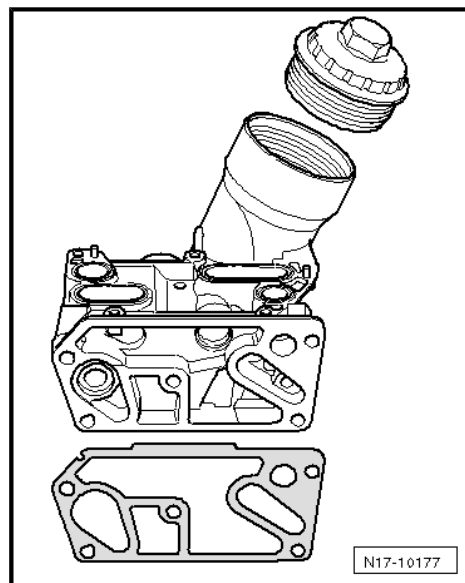
- Unscrew oil filter housing and disconnect connector for oil pressure switch. Remove oil filter housing.

Install in reverse order.





- Renew housing seal.
- Replenish coolant ⇒ [page 72](#) .
- Check engine oil level, renew if mixed with coolant
⇒ [page 57](#) .



2.3 Removing and installing oil sump

⇒ „2.3.1 Removing“, page 62

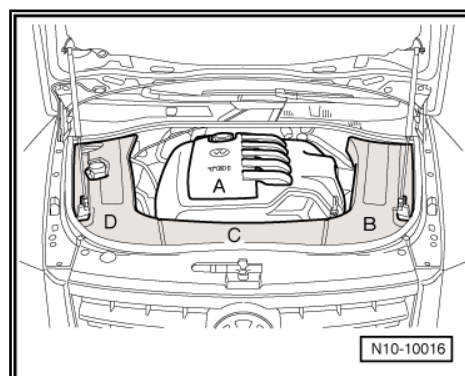
⇒ „2.3.2 Installing“, page 63

Special tools and workshop equipment required

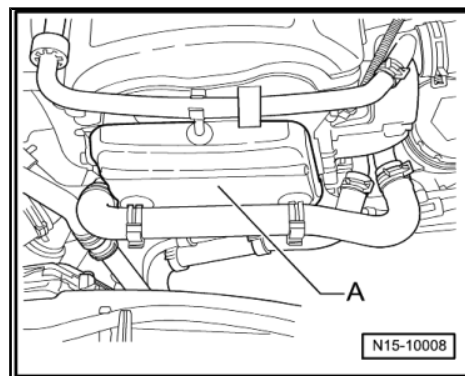
- ◆ Hand drill with plastic brush
- ◆ Sealant as per ⇒ Electronic parts catalogue (ETKA) .
- ◆ Flat scraper

2.3.1 Removing

- Remove engine cover -A- and engine compartment covers -B-, -C- and -D-, if fitted.

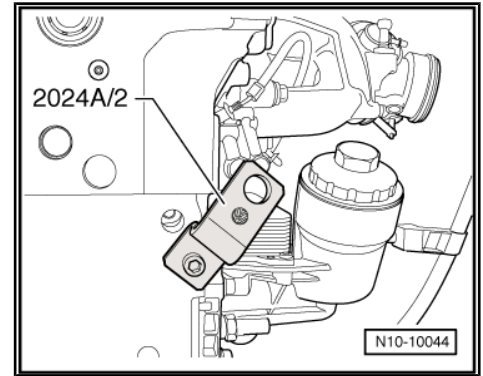


- Remove noise insulation -A- on engine side.

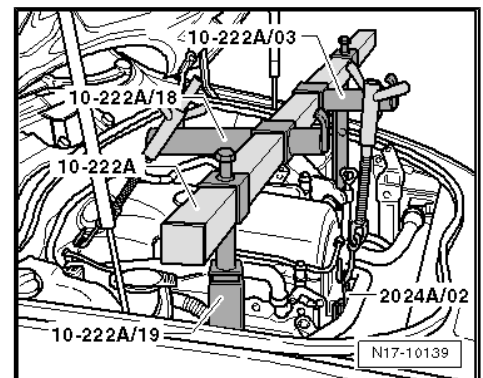




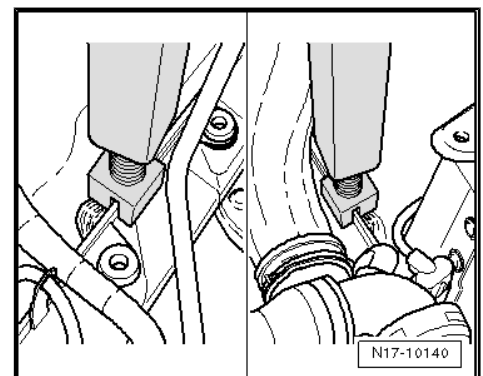
- Fit lifting tackle -2024A- on cylinder block as shown.



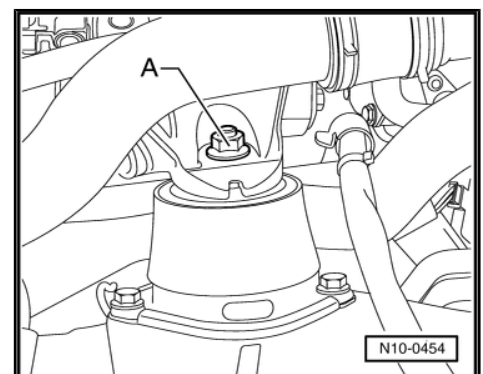
- Fit support bracket -10 - 222 A- .



- Observe mounting points on longitudinal members.



- Remove assembly mounting nut/bolt -A- on both sides of engine.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Noise insulation; Assembly overview - noise insulation .
- Remove subframe ⇒ Running gear, axles, steering; Rep. gr. 40 ; Fixing subframe in position .
- Unbolt coolant pipe from sump.
- Pull connector off oil level and oil temperature sender -G266- .
- Remove noise insulation.
- Drain engine oil.
- Remove sump.
- Loosen sump with light blows of a rubber headed hammer if necessary.



2.3.2 Installing

- Remove sealant residue from cylinder block with a flat scraper.



- Remove sealant residue on sump, using electric drill with plastic brush attachment (wear eye protection).
- Clean sealing surfaces. They must be free of oil and grease.



Note

- ◆ *Observe expiry date of sealing compound.*
- ◆ *The sump must be installed within 5 minutes of applying silicone sealing compound.*

- Cut off tube nozzle at forward marking (Ø of nozzle approx. 3 mm).
- Apply silicone sealing compound, as shown, to clean sealing surface on sump. Sealant bead must be:
 - ◆ 2 ... 3 mm thick.
 - ◆ Run bead along inner side of bolt holes -arrows-.



Note

The sealant bead must not be thicker, otherwise excess sealing compound will enter the oil sump and may block the oil suction line strainer.

- Apply silicone sealing compound bead as shown to the clean sealing surface of the sump.
- Install sump immediately and tighten all sump bolts lightly.



Note

The sump must be flush with the cylinder block and the control housing cover.

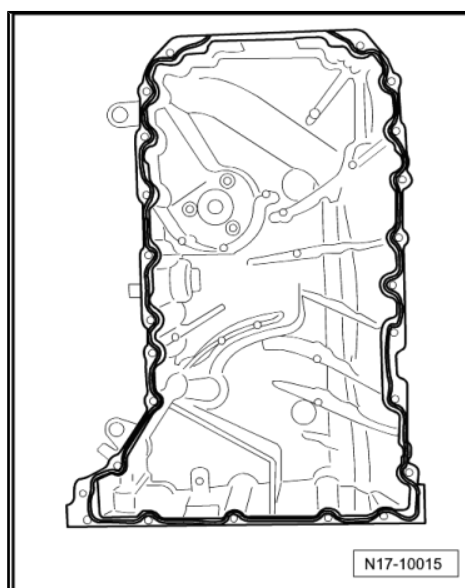
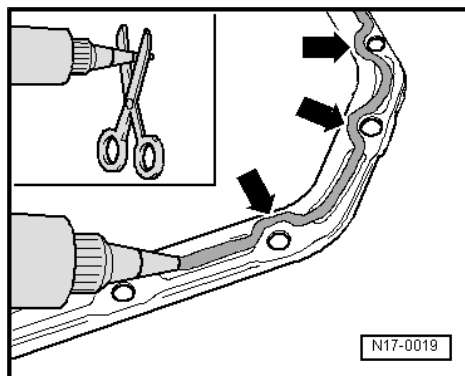
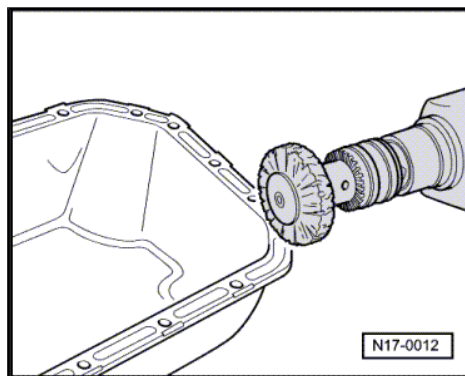
- Tighten oil sump bolts to 15 Nm.
- Tighten bolts securing sump to gearbox to 45 Nm.



Note

Allow sealing compound to dry for approx. 30 minutes after installing sump. Only then fill with engine oil.

Further assembly is basically the reverse of the dismantling sequence.

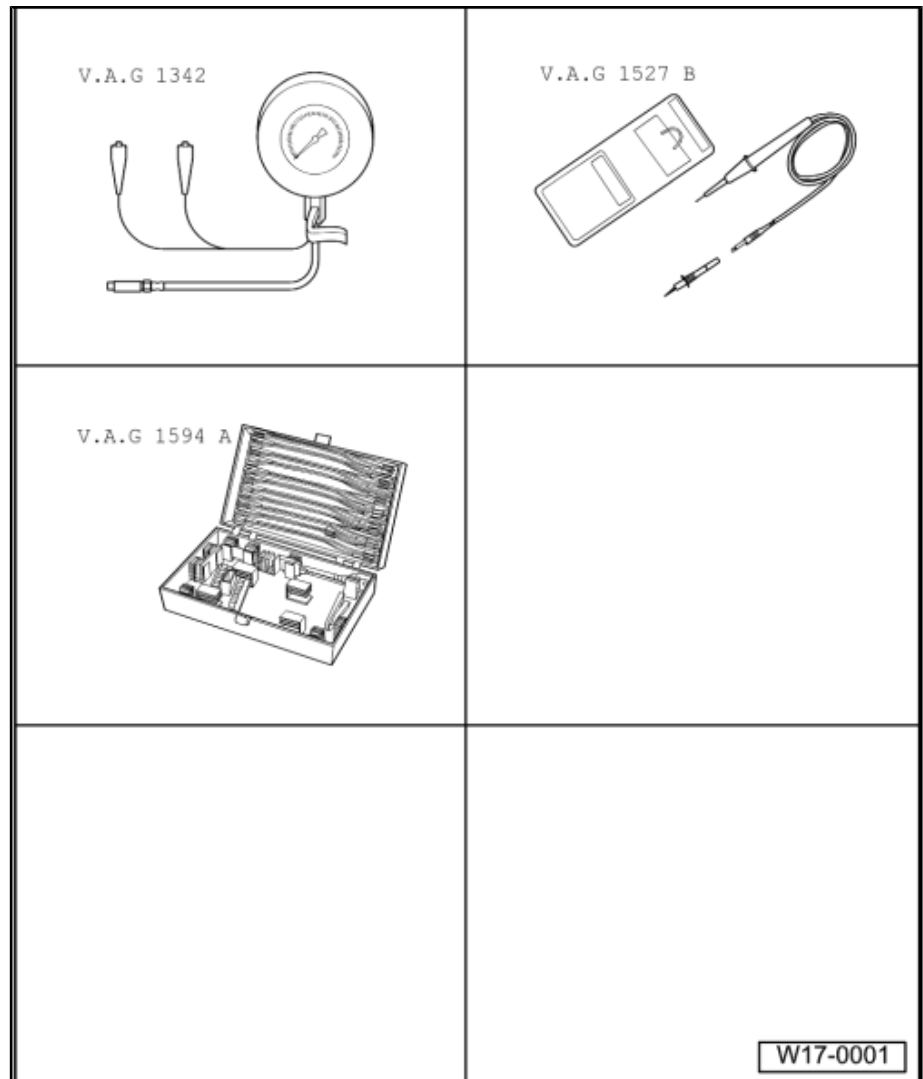




2.4 Checking oil pressure and oil pressure switch

Special tools and workshop equipment required

- ◆ Oil pressure tester - V.A.G 1342-
- ◆ Voltage tester - V.A.G 1527 B-
- ◆ Auxiliary measuring set - V.A.G 1594 A-



Note

Functional check and repair of the optical and acoustic oil pressure warning: ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Test prerequisites

- Engine oil temperature min. 80 °C.
- Engine oil level OK.

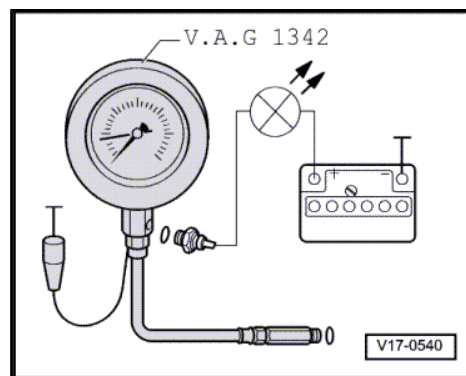
Test procedure

- Bring lock carrier into service position: ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; service position .
- Remove air conditioner compressor: ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor from and to bracket



- Suspend air conditioner compressor so that lines and hoses are not stretched, kinked or bent. Nor must they enter the radiator fan.
- Remove oil pressure switch -F1- and screw into tester.
- Screw tester into oil filter housing in place of oil pressure switch.
- Connect brown wire of tester to earth (-).
- Connect voltage tester -V.A.G 1527 B- to battery positive (+) and oil pressure switch using cable from auxiliary measuring set -V.A.G 1594/C-. LED must not light up.
- Install air conditioner compressor: ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor from and to bracket .
- Start engine and increase speed slowly. At 0.75 ... 1.05 bar, the LED must light up; otherwise renew oil pressure switch.
- Increase engine speed further. At 2000 rpm and an oil temperature of 80°C, the oil pressure should be at least 2.0 bar.

At higher engine speed, oil pressure must not exceed 7.0 bar.





19 – Cooling

1 Removing and installing parts of cooling system



WARNING

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- ◆ *All the various lines, e.g. for activated charcoal filter system, electrical wiring as well as*
- ◆ *Fuel lines*
- ◆ *Hydraulic lines*
- ◆ *Coolant and refrigerant lines*
- ◆ *Lines for brake fluid*
- ◆ *and vacuum lines*
- ◆ *must be routed in their original positions.*
- ◆ *Ensure that there is sufficient clearance to all moving or hot components.*
- ◆



Note

- ◆ *When the engine is warm, the cooling system is under pressure. If necessary, release pressure before beginning repair work.*
- ◆ *Hoses are secured with spring-type clips. In case of repair, only use spring-type clips.*
- ◆ *Spring-type clip pliers -VAS 5024- are recommended for installation of spring-type clips.*
- ◆ *When installing coolant hoses, route stress-free so that they do not come into contact with other components (observe markings on coolant connection and hose).*

Test for leaks in cooling system using cooling system tester - V.A.G 1274- and adapters -V.A.G 1274/8- and -V.A.G 1274/9- .



- ⇒ „1.1 Parts of cooling system, body side“, page 68 .
- ⇒ „1.2 Assembly overview - radiator fan “, page 69 .
- ⇒ „1.3 Removing and installing fan support“, page 69
- ⇒ „1.4 Parts of cooling system, engine side“, page 70 .
- ⇒ „1.5 Coolant hose schematic diagram“, page 72 .
- ⇒ „1.6 Draining and filling coolant“, page 72 .
- ⇒ „1.7 Removing and installing radiator“, page 75 .
- ⇒ „1.8 Removing and installing coolant pump“, page 77 .
- ⇒ „1.9 Checking oil cooler for leaks“, page 83

1.1 Parts of cooling system, body side



Note

Coolant hose schematic diagram ⇒ [page 72](#) .

1 - Radiator/cooler

- ☐ Removing and installing
⇒ [page 75](#)
- ☐ After renewing, renew
entire coolant.
- ☐ Coolant hose schematic
diagram ⇒ [page 72](#) .

2 - Retaining clip

- ☐ Check for secure seat-
ing.

3 - Condenser

4 - Gearbox oil cooler

- ☐ For gear oil
- ☐ Only vehicles with an
automatic gearbox.

5 - Oil cooler

- ☐ For power-assisted
steering

6 - Lock carrier

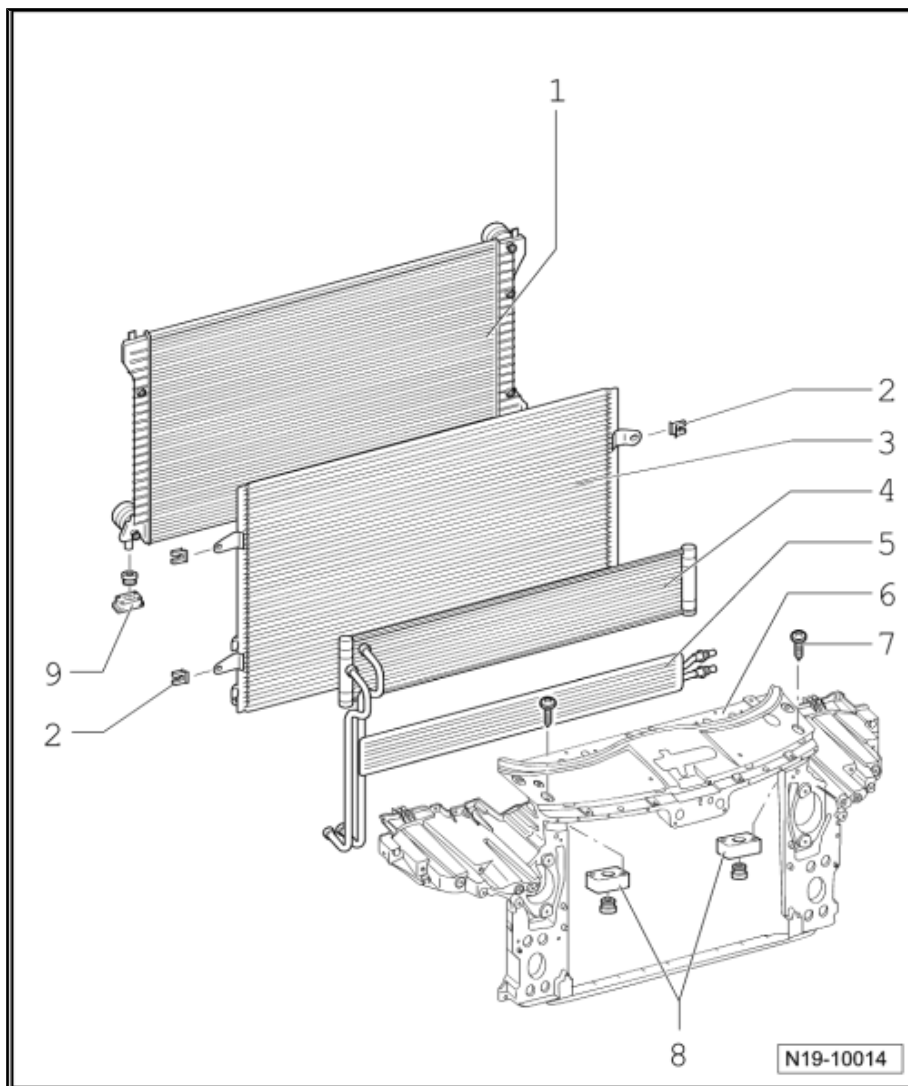
7 - 10 Nm

8 - Rubber bush

- ☐ For lock carrier

9 - Rubber bush

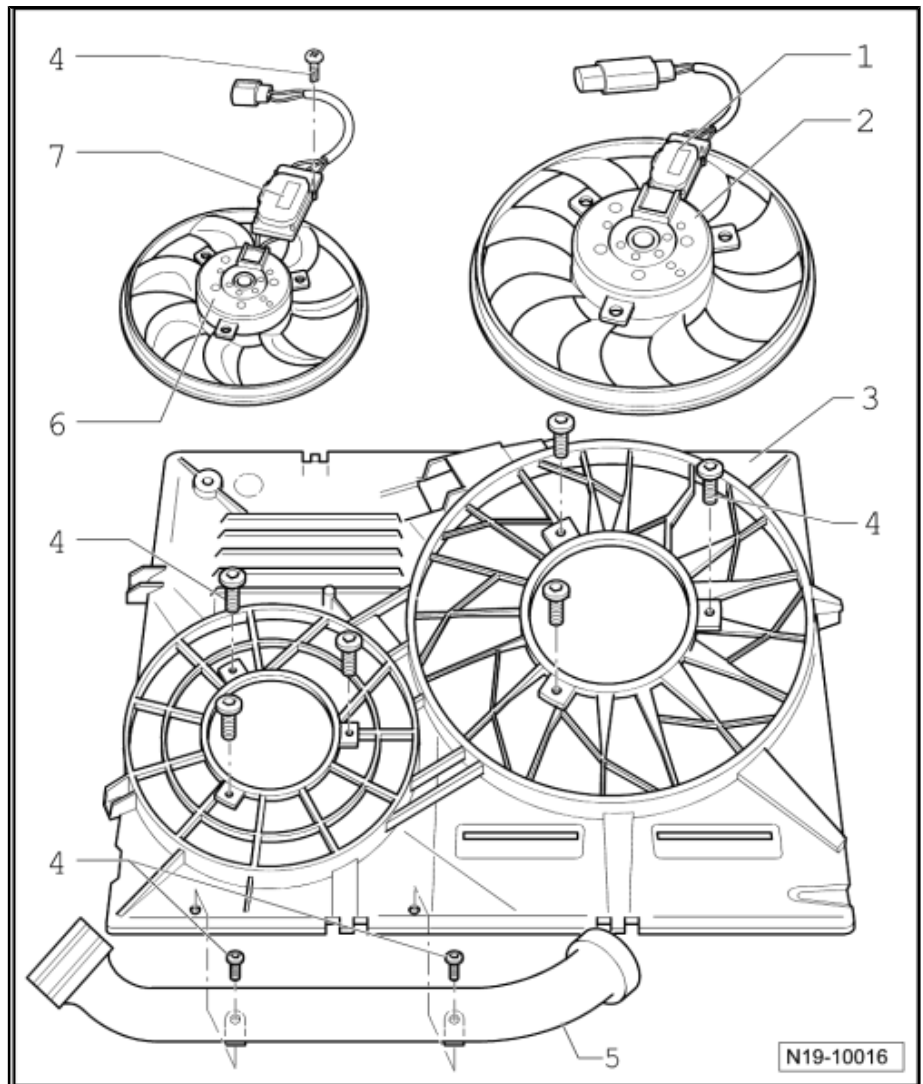
- ☐ For bottom of radiator





1.2 Assembly overview - radiator fan

- 1 - Radiator fan control unit - J293-
- 2 - Radiator fan -V7-
- 3 - Fan support
 - Removing and installing
⇒ [page 69](#)
- 4 - 10 Nm
- 5 - Charge air pipe
- 6 - Radiator fan 2 -V177-
- 7 - Radiator fan control unit - J671-



1.3 Removing and installing fan support

Removing

- Drain coolant ⇒ [page 72](#) .
- Pull off upper coolant hose on radiator.
- Remove front bumper ⇒ General body repairs, exterior; Rep. gr. 63 ; Assembly overview - front bumper
- Bring lock carrier into service position ⇒ General body repairs, exterior; Rep. gr. 50 ; Body - front; Lock carrier - service position .
- Remove charge air pipe from fan support.
- Detach the connectors of the two fans.

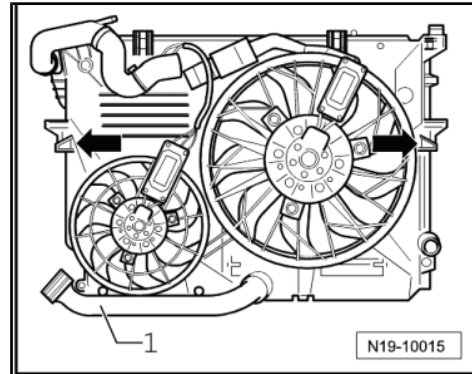


- Release securing devices -arrows- and remove fans with fan support.

Installing

Installation is carried out in the reverse order. When installing, note the following:

- Fan support must engage in its intended fastenings.
- Install charge air pipe and tighten to 10 Nm.
- Fill coolant system with coolant ⇒ [page 72](#) .



1.4 Parts of cooling system, engine side

1 - 10 Nm

2 - Coolant pipe

- ❑ Coolant hose schematic diagram ⇒ [page 72](#) .

3 - Seal

- ❑ Renew.

4 - Seal

- ❑ Renew.

5 - Connection

- ❑ Coolant hose schematic diagram ⇒ [page 72](#) .

6 - 10 Nm

7 - Gasket

- ❑ Renew.
- ❑ Note installation position.

8 - Thermostat

- ❑ Note installation position.
- ❑ Checking: heat thermostat in water.
- ❑ Opening begins at approx. 87 °C.
- ❑ Ends at approx. 102 °C.
- ❑ Opening stroke at least 8 mm.

9 - Thermostat housing

10 - Connecting hose

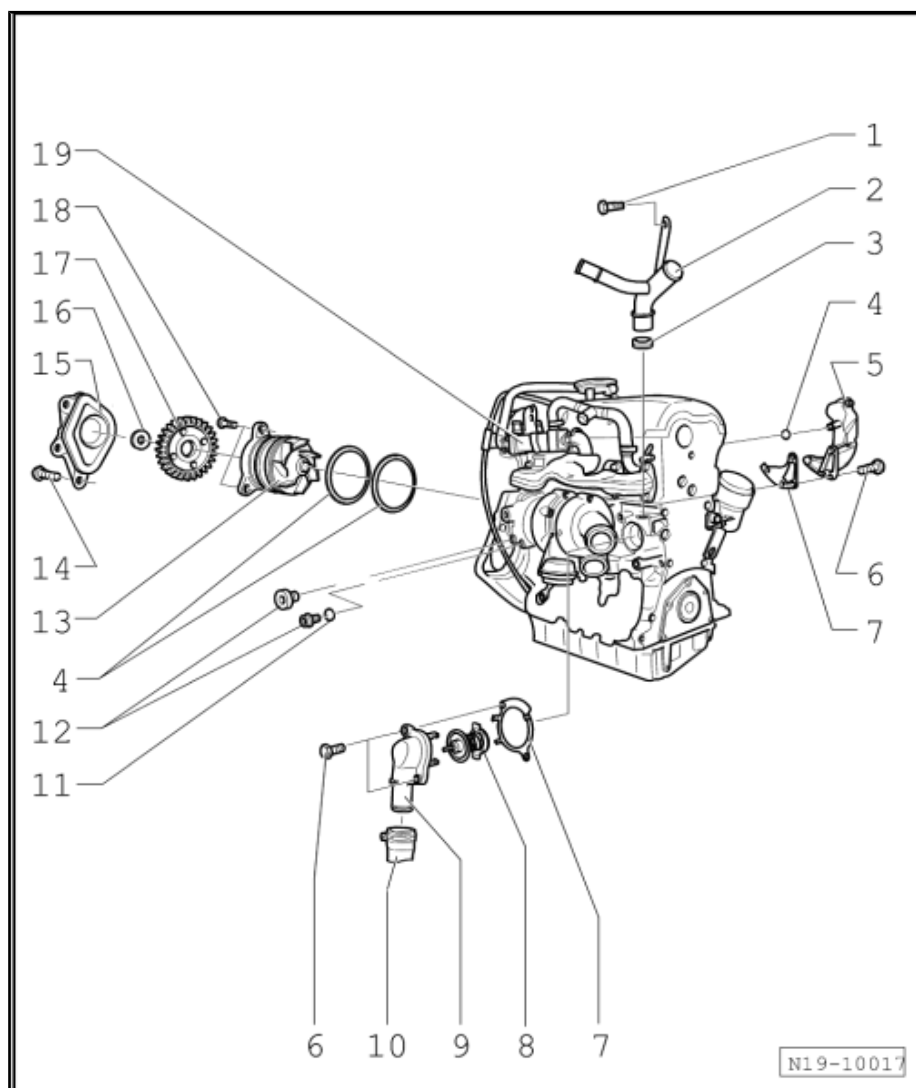
- ❑ Coolant hose schematic diagram ⇒ [page 72](#) .

11 - Seal

- ❑ Renew.

12 - Coolant drain plug, 20 Nm

- ❑ Remove to remove coolant pump.
- ❑ On vehicles with particulate filter the front exhaust pipe must be removed with particulate filter ⇒ [page 146](#) .





13 - Coolant pump

- ☐ Removing and installing ⇒ [page 77](#)

14 - 20 Nm

15 - Cover

- ☐ For coolant pump.
- ☐ Renew.
- ☐ Lightly coat gasket with oil when installing.

16 - 84 Nm

17 - Gear wheel

- ☐ For coolant pump.
- ☐ Check for damage.
- ☐ Removing and installing ⇒ [page 77](#)

18 - 20 Nm + 90° further

- ☐ Renew.

19 - Exhaust gas recirculation cooler

- ☐ Vehicles with automatic gearbox and exhaust gas recirculation changeover valve.
- ☐ Removing and installing
- ☐ Coolant hose schematic diagram ⇒ [page 72](#) .



1.5 Coolant hose schematic diagram

1 - Expansion tank

- ☐ Renew seal if damaged.
- ☐ Check cooling system for leaks with cooling system tester -V.A.G 1274- and adapter - V.A.G 1274/8- .
- ☐ Check cap using cooling system tester -V.A.G 1274- and adapter - V.A.G 1274/9- .
- ☐ Test pressure 1.4 ... 1.6 bar.

2 - Cylinder head/cylinder block

3 - Engine oil cooler

4 - Heat exchanger for heater unit

5 - Fuel cooler

6 - Change-over valve

- ☐ For coolant circuits

7 - Radiator/cooler

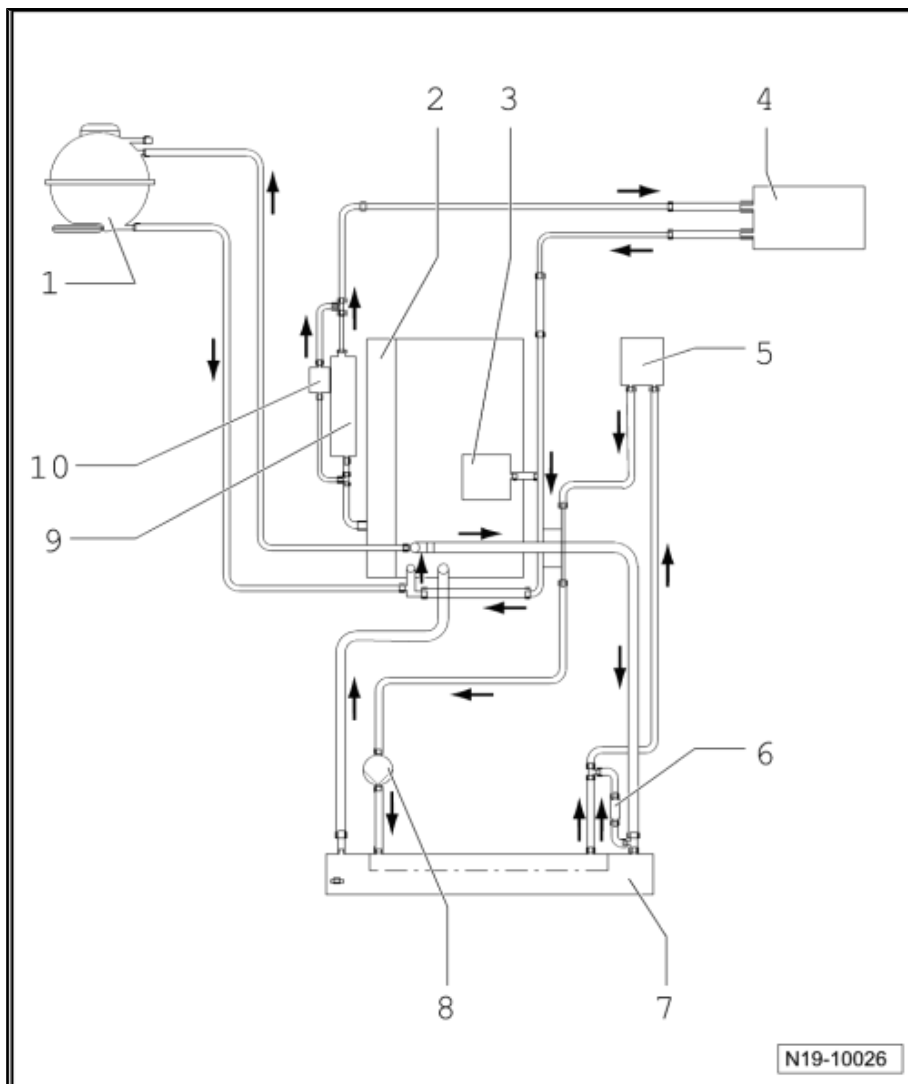
8 - Fuel cooling pump -V166-

9 - Radiator/cooler

- ☐ For exhaust gas recirculation.

10 - Change-over flap

- ☐ For exhaust gas recirculation.
- ☐ Only vehicles with an automatic gearbox.



The connection diagram for vehicles with an auxiliary heater/pre-heater is located in ⇒ Rep. gr. 82 ; Auxiliary heater/preheater .

The coolant run-on pump (circulation pump -V55-) is located in ⇒ Rep. gr. 80 ; Heater .

1.6 Draining and filling coolant

⇒ „1.6.1 Draining“, page 73

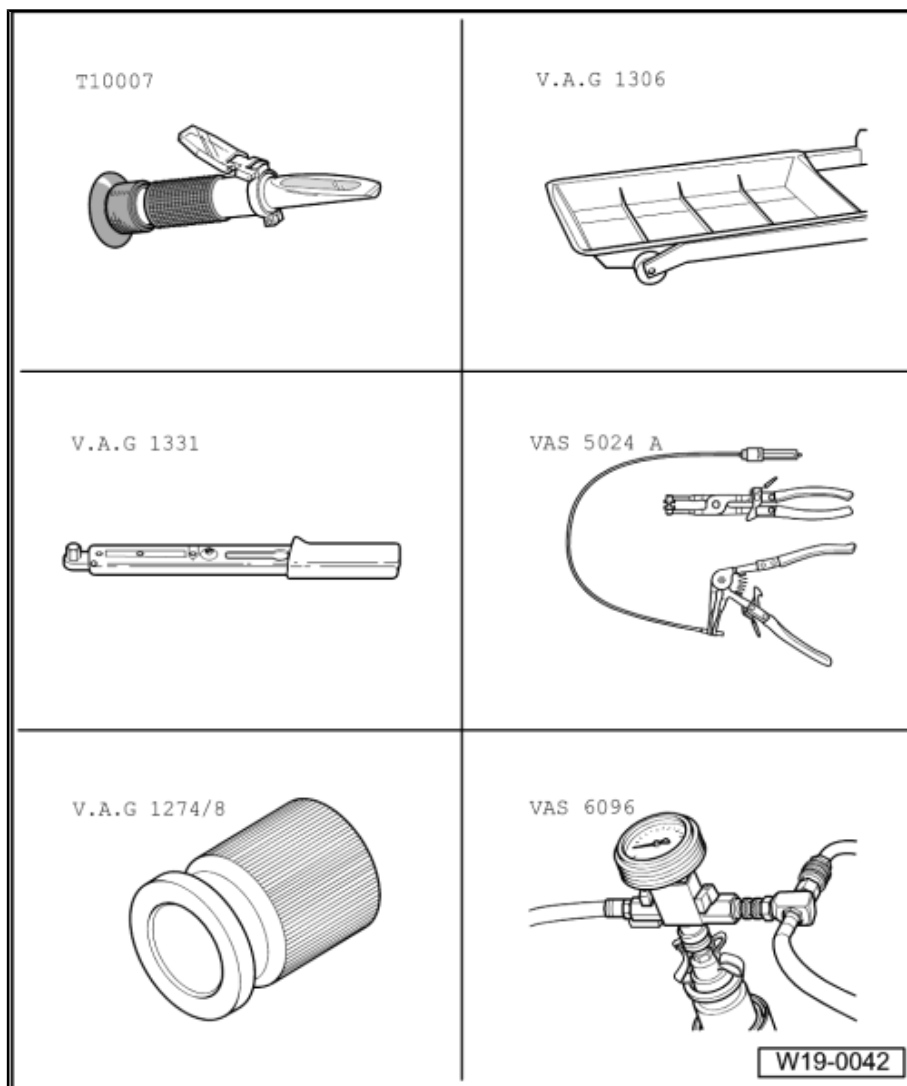
⇒ „1.6.2 Filling“, page 74

⇒ „1.6.3 Procedure“, page 75



Special tools and workshop equipment required

- ◆ Refractometer -T10007-
- ◆ Drip tray -V.A.G 1306-
- ◆ Torque wrench (5 ... 50 Nm) -V.A.G 1331-
- ◆ Spring-type clip pliers -VAS 5024 A-
- ◆ Adapter -V.A.G 1274/8-
- ◆ Cooling system charge unit -VAS 6096-



1.6.1 Draining

- Open filler cap on coolant expansion tank.



WARNING

Hot steam may escape when expansion tank is opened. Place cloth over cap and open with caution.

- Remove noise insulation.

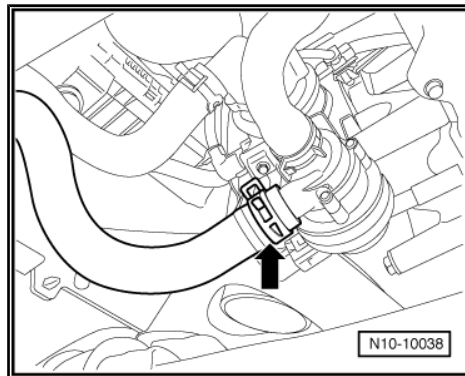


- To drain coolant, pull coolant hose -arrow- off fuel cooling pump -V166- .



Note

Follow disposal regulations for coolant!



1.6.2 Filling



Note

The amount of water used in the coolant mixture has a great influence on its effectiveness. Because the water quality differs from country to country and even region to region, Volkswagen has decided to define the quality of the water to be used in the coolant system. Distilled water fulfils all requirements. It is therefore recommended that distilled water be mixed with the coolant whenever an older model's coolant is replenished or replaced. For newer models (model year 2010 ►) the use of distilled water is absolutely essential and compulsory.



Caution

Only distilled water may be mixed with G12 plus-plus. The use of distilled water ensures optimum protection against corrosion.



Note

- ◆ *Use only coolant additive G 12 plus-plus in accordance with TL VW 774 G.*
- ◆ *It is recommended to use distilled water only for mixing.*
- ◆ *Coolant additives marked „in accordance with TL VW 774 G“ prevent lime accretion, frost damage and corrosion. Moreover, the boiling temperature is raised. Therefore, the cooling system must be filled all year round with coolant additive.*
- ◆ *Because of its higher boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- ◆ *The frost protection must be guaranteed to approx. -25 °C. (In countries with an arctic climate, down to approx. -35 °C).*
- ◆ *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The coolant additive concentration must be at least 40%.*
- ◆ *If a stronger anti-freeze mixture is necessary due to harsher weather conditions, the coolant additive content can be increased. However, this is only permitted to 60% (antifreeze protection to about -40°C). Since the frost protection will otherwise be reduced again and also the cooling effect will be worsened.*
- ◆ *The Refractometer -T10007- is recommended for determining the current anti-freeze density.*
- ◆ *Do not reuse old coolant.*

Recommended mixture ratios:

Frost protection to	Amount of anti-freeze	G 12 plus ¹⁾ G 12 plus-plus ¹⁾	Water
-25 °C	40 %	4.0 l	5.0 l
-35 °C	50 %	4.5 l	4.5 l

1) The quantity of coolant can vary depending upon vehicle equipment.

1.6.3 Procedure

- Push lower coolant hose onto radiator union and secure.
- Screw adapter -V.A.G 1274/8- onto expansion tank.
- Fill coolant circuit with cooling system charge unit -VAS 6096- .
⇒ Operating instructions for cooling system charge unit VAS 6096 .

1.7 Removing and installing radiator

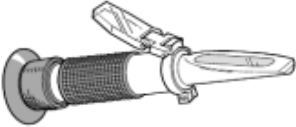
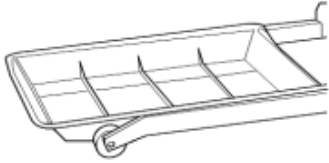
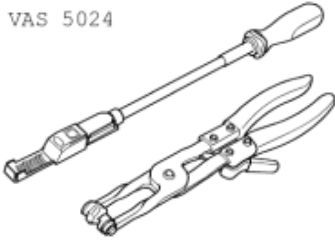
⇒ „1.7.1 Removing“, page 76

⇒ „1.7.2 Installing“, page 77



Special tools and workshop equipment required

- ◆ Refractometer -T10007-
- ◆ Drip tray -V.A.G 1306-
- ◆ Torque wrench -
V.A.G 1331- (5 ... 50 Nm)
- ◆ Spring-type clip pliers -
VAS 5024-

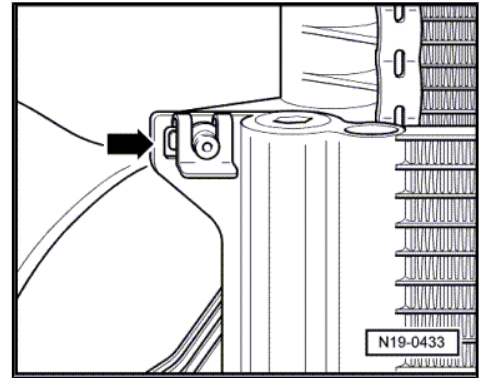
T10007 	V.A.G 1306 
V.A.G 1331 	VAS 5024 
	W19-0019

1.7.1 Removing

- Drain coolant ⇒ [page 72](#) .
- Pull all coolant hoses off radiator.
- Remove front bumper ⇒ General body repairs, exterior; Rep. gr. 63 ; Assembly overview - front bumper
- Bring lock carrier into service position ⇒ General body repairs, exterior; Rep. gr. 50 ; Body - front; Lock carrier - service position .
- Remove fans together with fan support ⇒ [page 69](#) .



- Loosen retaining clips for condenser and gearbox oil cooler.
- Remove upper securing bolts for radiator and remove radiator upwards.



1.7.2 Installing

Installation is carried out in the reverse order. When installing, note the following:

- Replenish coolant ⇒ [page 72](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Bolt lock carrier in position ⇒ General body repairs, exterior; Rep. gr. 50 ; Body - front; Lock carrier service position.
- Install front bumper: ⇒ General body repairs, exterior; Rep. gr. 63 ; Assembly overview - front bumper
- Check headlight adjustment and correct if necessary ⇒ Maintenance ; Booklet 17.1 .

1.8 Removing and installing coolant pump

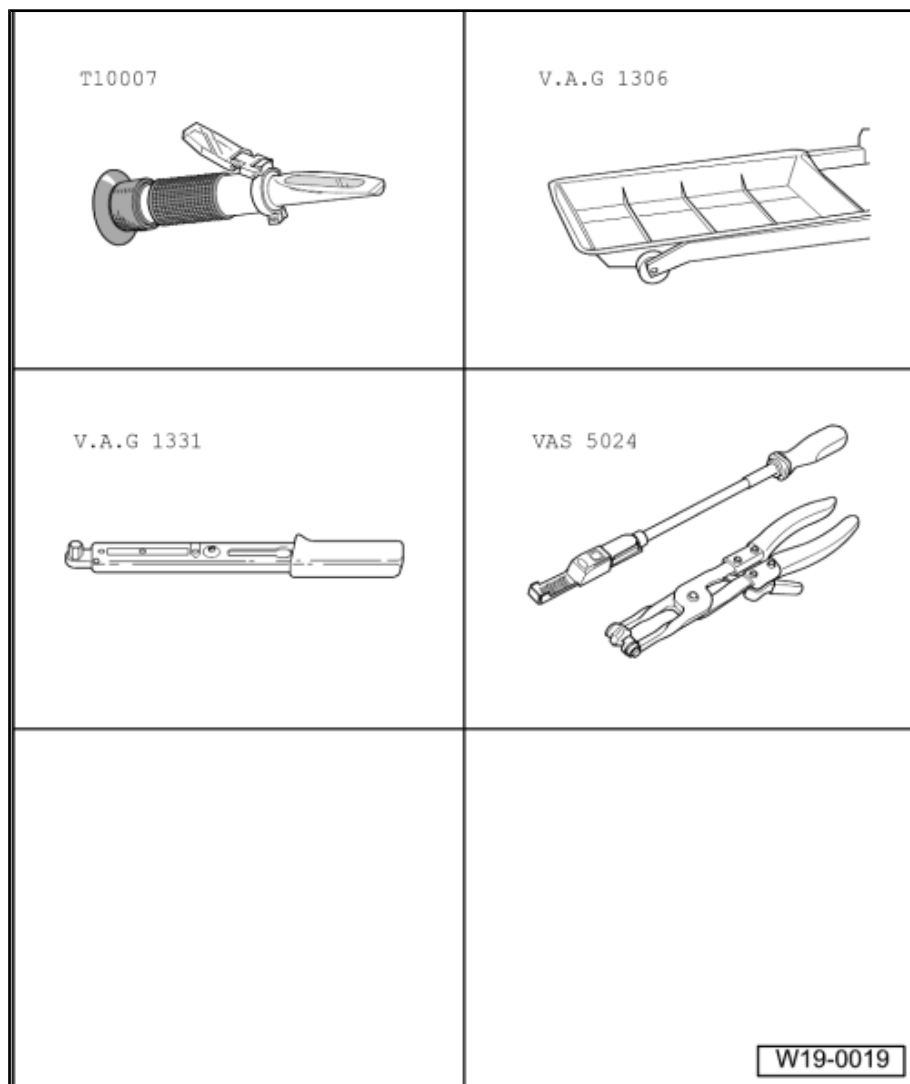
⇒ „1.8.1 Removing“, [page 79](#)

⇒ „1.8.2 Installing“, [page 81](#)

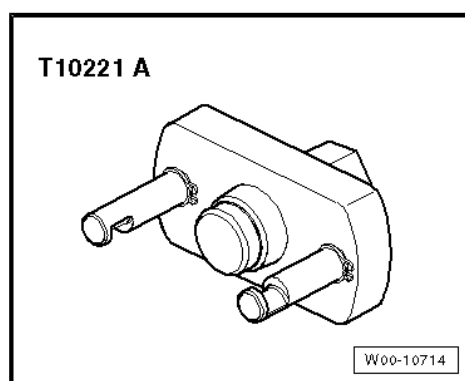


Special tools and workshop equipment required

- ◆ Refractometer -T10007-
- ◆ Drip tray -V.A.G 1306-
- ◆ Torque wrench -
V.A.G 1331- (5 ... 50 Nm)
- ◆ Spring-type clip pliers -
VAS 5024-

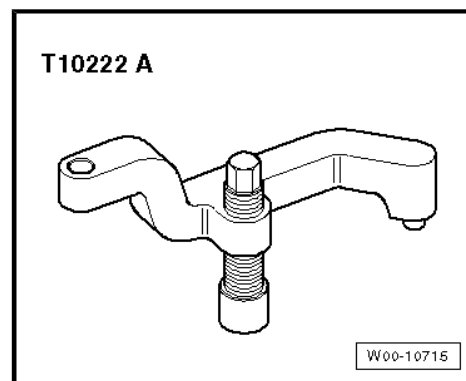


- ◆ Puller -T10221A-

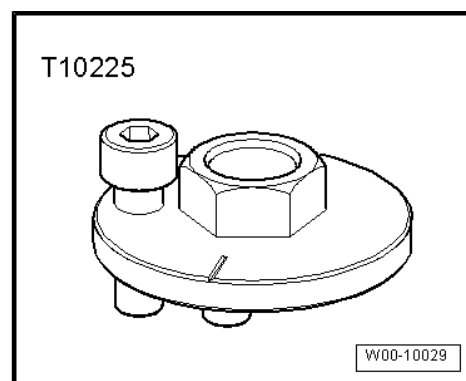




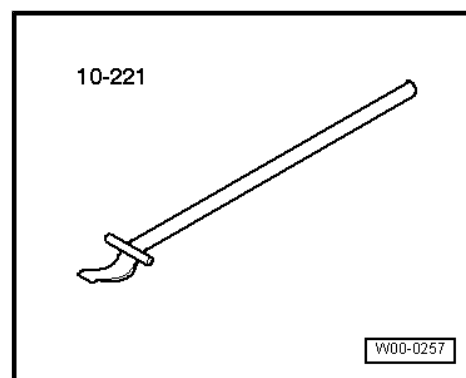
◆ Puller -T10222A-



◆ Special wrench -T10225-



◆ Puller hooks -10-221-



1.8.1 Removing



WARNING

Risk of scalding.

The cooling system is under pressure, when the engine is warm the coolant temperature can be above 100 °C.

Before carrying out repairs, release pressure and allow temperature to drop as necessary.

Vehicles with engine codes BAC and BLK

- Loosen exhaust pipe and starter catalytic converter from turbocharger and gearbox. It is not necessary to remove the catalytic converter.

Vehicles with engine codes BPD and BPE

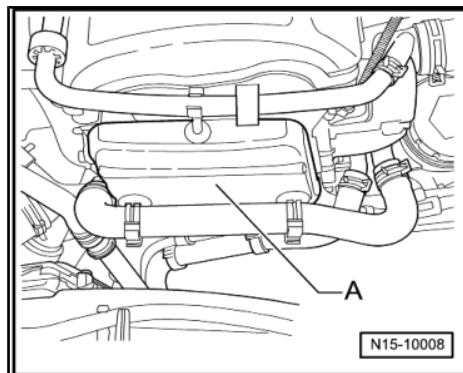
- Remove exhaust gas recirculation cooler ⇒ [page 157](#).



- Remove particulate filter ⇒ [page 147](#) .

For all engine codes

- Drain coolant ⇒ [page 72](#) .
- Remove coolant drain plugs ⇒ [Item 12 \(page 70\)](#) .
- Remove coolant pump cover ⇒ [Item 15 \(page 71\)](#) .
- Remove noise insulation -A- from No. 1 cylinder end of engine block.



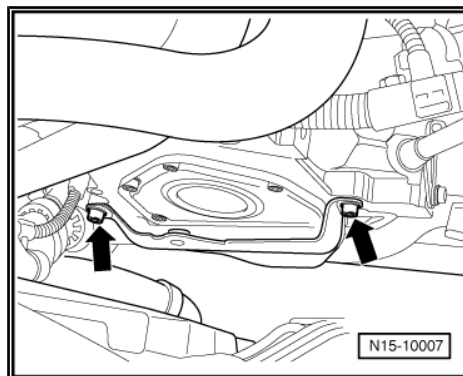
- Remove bolts -arrows- and remove bracket for noise insulation.
- Lever sealing cover out of sealing flange on No. 1 cylinder end of block using lever -10-221- .



Note

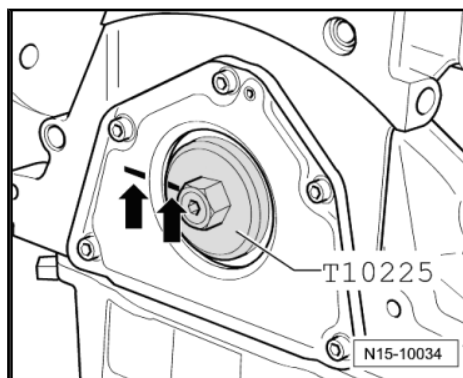
Renew sealing cover after removing.

- Bolt special wrench -T10225- onto crankshaft. To do this, turn screw into crankshaft through centre of tool and tighten to 20 Nm.



Note

- ♦ *It is only possible to bolt special wrench -T10225- onto crankshaft in one position.*
- ♦ *To remove the coolant pump, the engine must not be at TDC.*

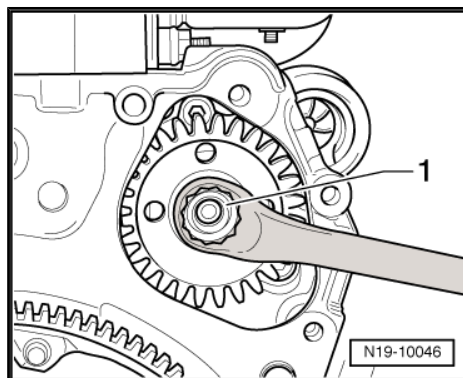


- Counterhold special wrench -T10225- using suitable tool, and loosen coolant pump securing nut -1-.



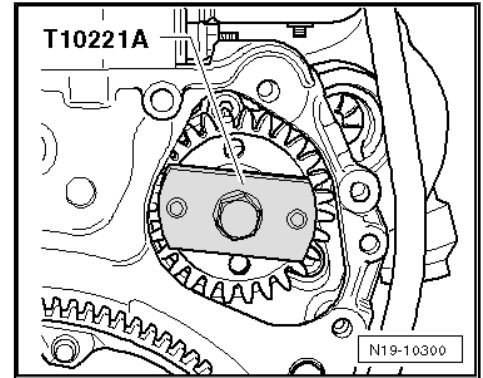
Note

For engines manufactured in the first batch, puller -T10221- cannot be fitted due to lack of clearance behind coolant pump gear. In this case release coolant pump gear by tapping lightly on its sides with a hammer and copper drift.

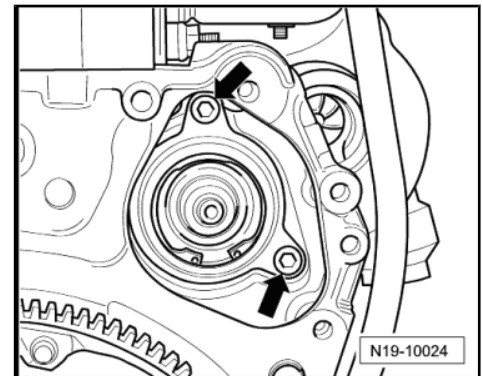




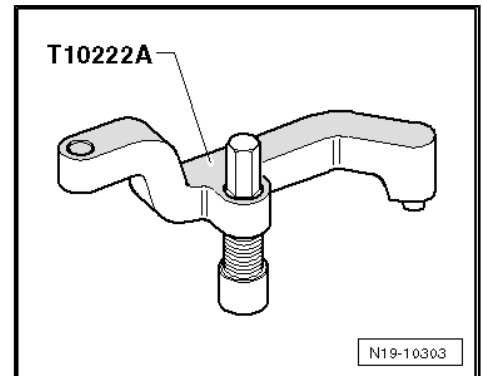
- Fit puller -T10221A- as shown and turn hexagon clockwise until the gear wheel can be removed from the pump.



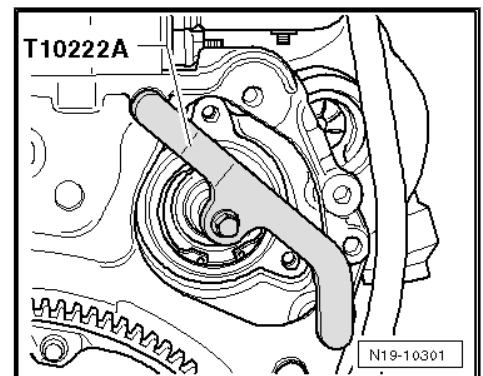
- Unscrew coolant pump securing bolts -arrows-.
- Prior to fitting, screw puller -T10222A- in and out to adjust, until spindle hexagon is flush with tool surface shown in grey.



Adjusting T 10222 A



- Fit adjusted puller -T10222A- , turn its bolt clockwise until the puller first contacts the cylinder block as shown and subsequently pulls the coolant pump out.



1.8.2 Installing

Installation is carried out in the reverse order. When installing, note the following:

- Wet new O-rings with coolant; do not use any other lubricants.



Note

Ensure the seals on the coolant pump are correctly seated.

- Fit coolant pump.
- Tighten new coolant pump securing bolts.

Torque settings ⇒ [Item 18 \(page 71\)](#)

- Fit gear wheel and tighten securing nut.

Torque settings ⇒ [Item 16 \(page 71\)](#)



Note

- ♦ *Tighten securing nut from underside of vehicle using a universal joint and extension, if necessary.*
- ♦ *The angle of the universal joint must not exceed max. 20°.*

- Install drain plugs with new seal and tighten.

Torque settings ⇒ [Item 12 \(page 70\)](#)

- Lightly coat sealing lip of coolant pump cover with oil.
- Install coolant pump cover .

Torque settings ⇒ [Item 14 \(page 71\)](#)

- Replenish coolant ⇒ [page 72](#) .

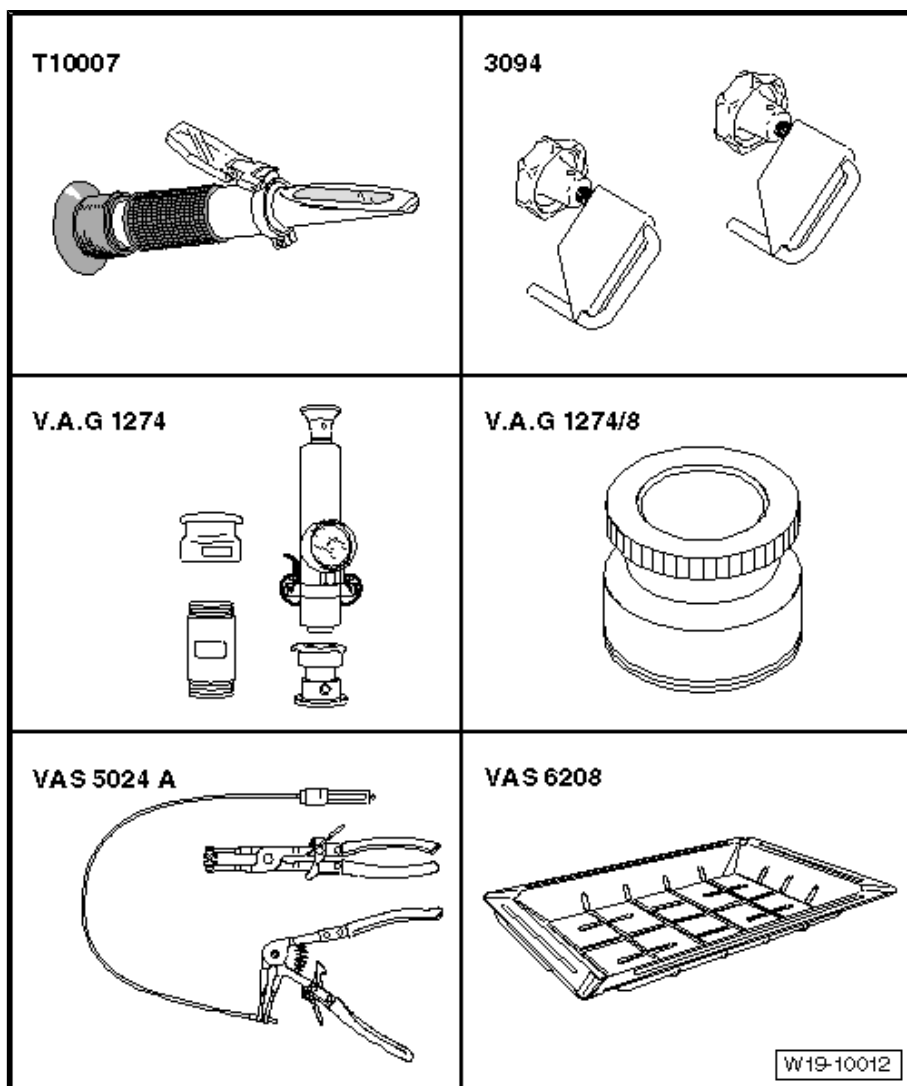
Further assembly is carried out in the reverse order of removal.



1.9 Checking oil cooler for leaks

Special tools and workshop equipment required

- ◆ Refractometer -T10007-
- ◆ Hose clips up to 25 mm Ø -3094-
- ◆ Cooling system tester - V.A.G 1274-
- ◆ Adapter for cooling system tester -V.A.G 1274/8-
- ◆ Spring-type clip pliers -VAS 5024 A-
- ◆ Drip tray -V.A.G 1306- or drip tray -VAS 6208-





- ◆ Torque wrench -V.A.G 1331-

Not illustrated

- ◆ Expansion tank -1K0 121 407 A- or expansion tank -1J0 121 407 B-
- ◆ Plug -191 211 343-
- ◆ Cap -1J0 121 324-
- ◆ Coolant hose -251 265 056-

Prerequisites:

- Engine cold

Test procedure

- Remove noise insulation. ⇒ General body repairs, exterior; Rep. gr. 50 ; Body - front; Assembly overview - noise insulation .
- Drain coolant ⇒ [page 72](#)
- Drain engine oil ⇒ [page 57](#) .
- Loosen hose clips using spring-type clip pliers -VAS 5024- .
- Remove oil cooler with housing ⇒ [page 59](#)



Note

- ◆ *Collect escaping coolant with drip tray -V.A.G 1306- or drip tray -VAS 6208- .*
- ◆ *Collect leaking engine oil with a cleaning cloth, if necessary.*

Checking when removed

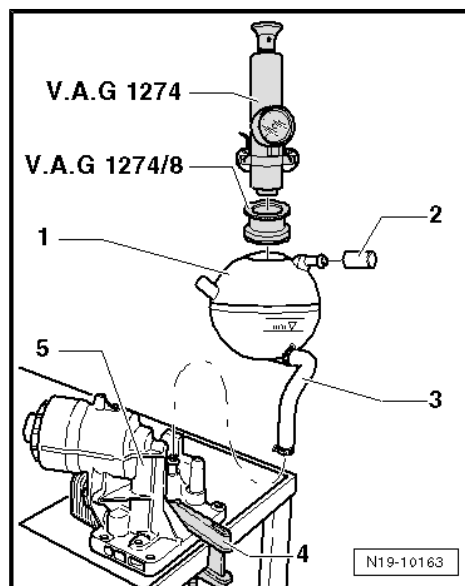
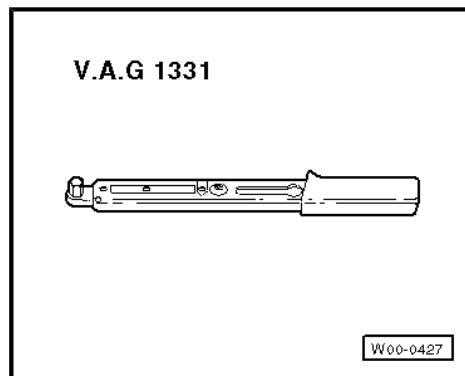
- Clamp housing with old seal on a suitable, level clean surface.
- Secure sealing plug -2- to breather connection of expansion tank -1-.
- Secure coolant hose -3- to engine oil cooler and expansion tank.
- Fill expansion tank up to „Max“ marking.
- Attach cooling system tester -V.A.G 1274- with cooling system tester adapter -V.A.G 1274/8- to expansion tank.
- Use hand pump on tester to create a pressure of about 1.6 bar.
- Watch pressure drop on pressure gauge. A pressure drop within 10 minutes is not permitted.

If pressure drops:

- Renew engine oil cooler ⇒ [page 59](#) .

Installation is carried out in the reverse order. When installing, note the following:

- Renew seal for housing.
- Check coolant level, replenish coolant if necessary ⇒ [page 72](#) .
- Check engine oil level, if necessary replenish oil ⇒ [page 57](#)





20 – Fuel supply system

1 Removing and installing parts of fuel supply system



Note

- ◆ *Hose connections are secured with quick-release couplings, spring-type or clamp-type clips.*
- ◆ *Renew clamp-type clips with spring-type clips.*
- ◆ *Fuel hoses on engine must be secured with spring-type clips only. The use of clamp or screw-type clips is not permissible.*
- ◆ *Assembly tool -VAS 5024A- or pliers -V.A.G 1921- are recommended for fitting spring-type clips.*

⇒ „1.1 Rules for cleanliness“, page 85 .

⇒ „1.2 Safety precautions when working on fuel supply system“, page 86 .

⇒ „1.3 Assembly overview - fuel tank with attachments (► model year 08)“, page 87

⇒ „1.4 Assembly overview - fuel tank with attachments (model year 08 ►)“, page 88

⇒ „1.5 Assembly overview - fuel filter with fuel cooler“, page 90 .

⇒ „1.6 Emptying fuel tank“, page 91

⇒ „1.7 Removing and installing fuel pump unit, fuel gauge sender and suction jet pumps (for vehicles ► model year 08)“, page 95

⇒ „1.8 Removing and installing fuel pump unit, fuel gauge sender and suction jet pumps (for vehicles model year 08 ►)“, page 97

⇒ „1.9 Removing and installing fuel tank with attached components“, page 100

⇒ „1.10 Checking fuel pumps“, page 102

⇒ „1.11 Checking tandem pump“, page 104

⇒ „1.12 Removing and installing tandem pump“, page 107

⇒ „1.13 Assembly overview - accelerator mechanism“, page 109 .

1.1 Rules for cleanliness

When working on the fuel supply and injection system, pay careful attention to the following „6 rules“ for cleanliness:

- ◆ Thoroughly clean all unions and surrounding areas before disconnecting.
- ◆ Place removed parts on a clean surface and cover. Use only lint-free cloths.
- ◆ Carefully cover opened components or seal if repairs cannot be carried out immediately.
- ◆ Install clean components only. Do not remove replacement parts from packing until immediately before installing. Do not



use parts that have not been stored in their packing (e.g. in tool boxes etc.).

- ◆ When system is open: do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.
- ◆ Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

1.2 Safety precautions when working on fuel supply system



WARNING

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- ◆ *All the various lines, e.g. for activated charcoal filter system, electrical wiring as well as*
- ◆ *Fuel lines*
- ◆ *Hydraulic lines*
- ◆ *Coolant and refrigerant lines*
- ◆ *Lines for brake fluid*
- ◆ *and vacuum lines*
- ◆ *must be routed in their original positions.*
- ◆ *Ensure that there is sufficient clearance to all moving or hot components.*

When removing and installing the fuel pump and fuel gauge sender from a full or partly filled fuel tank the following must be observed:

- ◆ Even before work commences, the extraction hose of an activated fume extraction system has to be placed in the vicinity of the assembly opening of the fuel tank to extract any escaping fumes. If no exhaust gas extraction system is available, a radial fan with a displacement greater than 15 m³/h can be used providing that motor is not in air flow.
- ◆ Prevent skin contact with fuel! Wear fuel-resistant gloves!



1.3 Assembly overview - fuel tank with attachments (► model year 08)

1 - Fuel tank filler neck

2 - Fuel tank

- ☐ When removing, support using engine and gearbox jack - V.A.G 1383 A- .
- ☐ Drain fuel tank using fuel extractor - VAS 5190- ⇒ [page 91](#)
- ☐ Removing and installing ⇒ [page 100](#)

3 - Flange

- ☐ Left side.
- ☐ Note installation position on fuel tank ⇒ [page 88](#) .

4 - Locking ring, 145 Nm

- ☐ Remove and install using wrench -T10202- .
- ☐ Check for secure seating.

5 - Fuel delivery unit

- ☐ Left side.

6 - Fuel gauge sender 3 - G237-

- ☐ Left side.
- ☐ Clipped into bottom of tank.

7 - Float for fuel gauge sender 3 -G237-

- ☐ On fuel delivery unit.

8 - Protective cover

- ☐ For bottom of fuel tank.

9 - Securing strap

- ☐ Note installation position.
- ☐ Check for secure seating.

10 - 20 Nm + 90° turn

11 - Protective cover

- ☐ For top of fuel tank

12 - Suction-jet pump

- ☐ Left side.
- ☐ Clipped into bottom of tank.

13 - Suction-jet pump

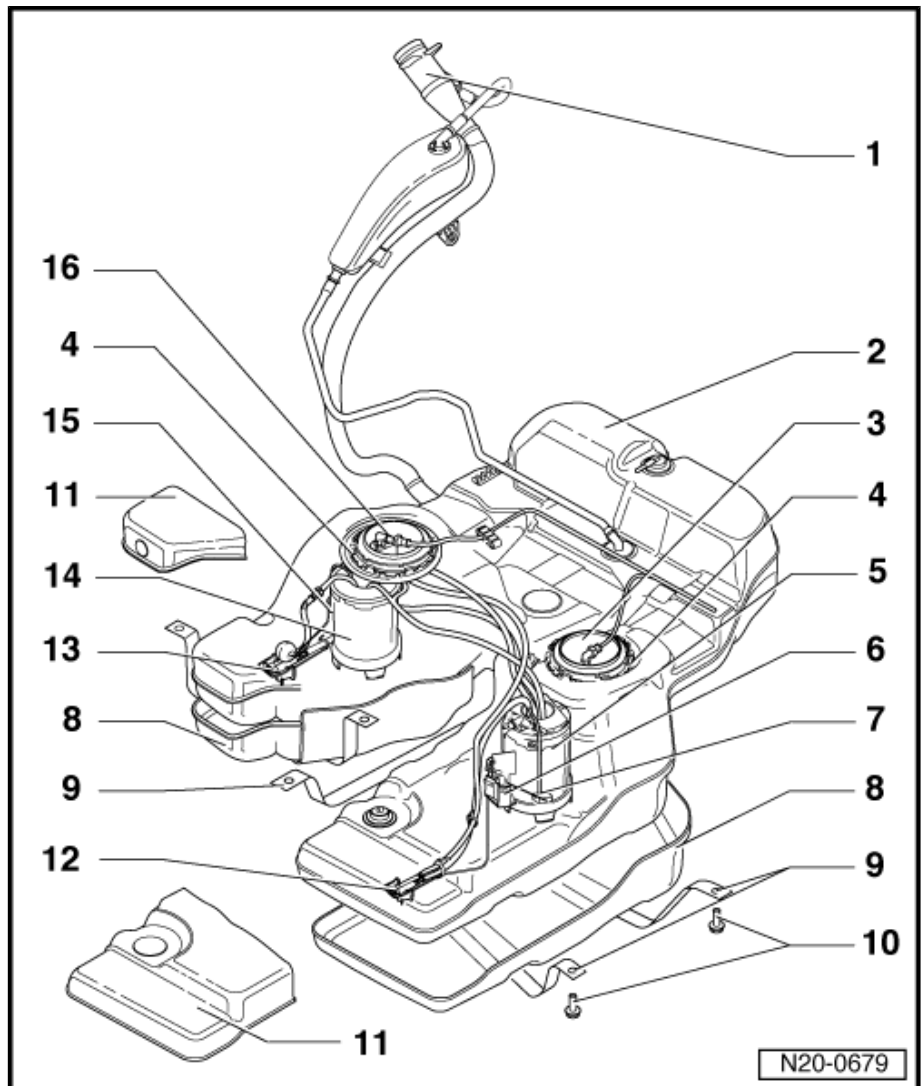
- ☐ Right side.

14 - Fuel delivery unit

- ☐ Right side.

15 - Fuel gauge sender -G-

- ☐ Right side.





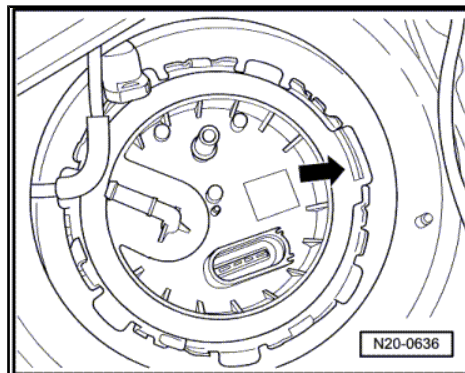
- ☐ Clipped into bottom of tank.

16 - Flange

- ☐ Right side.
- ☐ Note installation position on fuel tank ⇒ [page 88](#).

Fitting position of sender flange on fuel tank

- Insert sender flange with marking in direction of travel -arrow-.



1.4 Assembly overview - fuel tank with attachments (model year 08 ►)

1 - Fuel tank filler neck

2 - Fuel tank

- ☐ When removing, support using engine and gearbox jack - V.A.G 1383 A-.
- ☐ Drain fuel tank using fuel extractor - VAS 5190-.
- ☐ Removing and installing.

3 - Flange

- ☐ Left side.
- ☐ Note installation position on fuel tank ⇒ [page 89](#).

4 - Locking ring, 145 Nm

- ☐ Remove and install using wrench -T10202-.
- ☐ Check for secure seating.

5 - Fuel gauge sender 3 - G237-

- ☐ Left side.
- ☐ Clipped into bottom of tank.

6 - Suction-jet pump

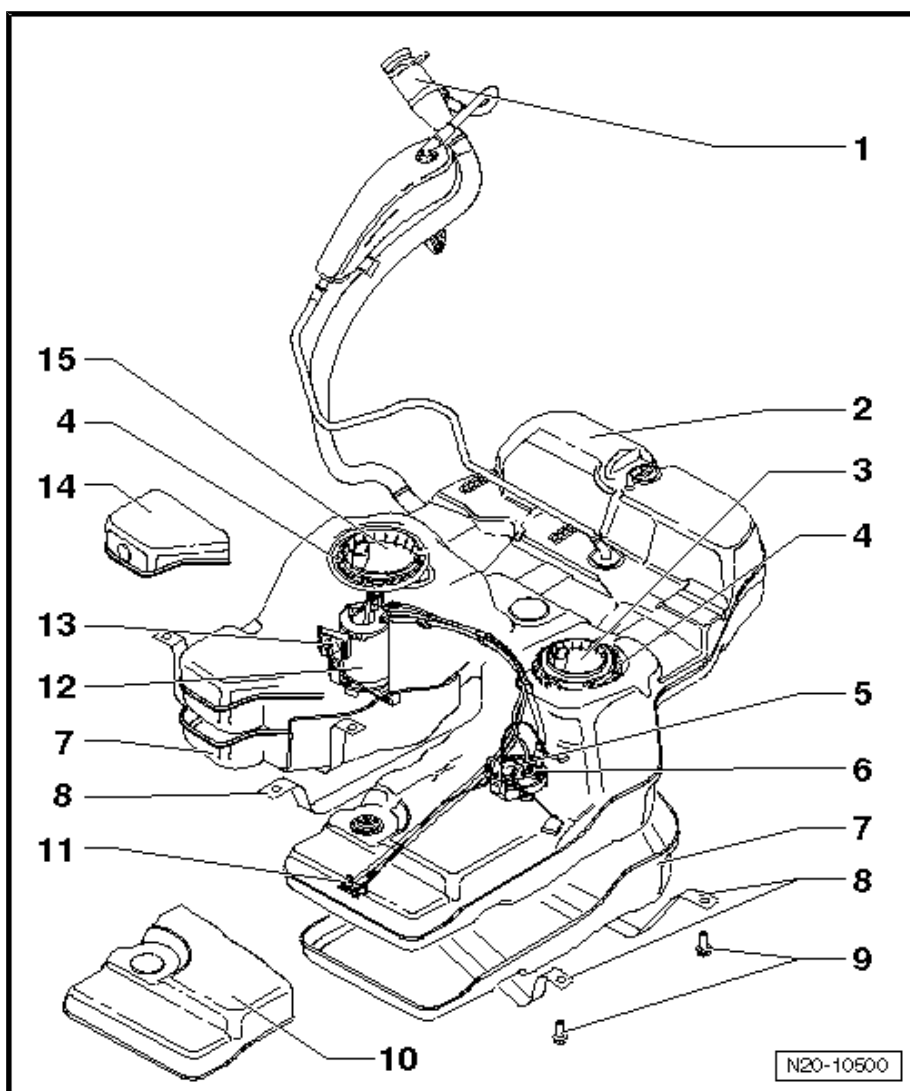
- ☐ Clipped into bottom of tank.

7 - Protective cover

- ☐ For bottom of fuel tank.

8 - Securing strap

- ☐ Note installation position.





- ☐ Check for secure seating.

9 - 20 Nm + 90° turn

10 - Protective cover

- ☐ For top of fuel tank

11 - Suction-jet pump

- ☐ Front left side

12 - Fuel delivery unit

- ☐ Right side.

13 - Fuel gauge sender -G-

- ☐ Right side.
- ☐ Clipped into bottom of tank.

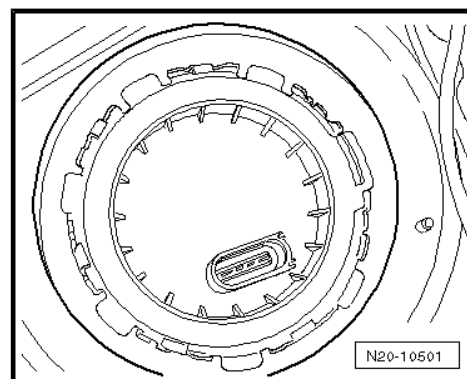
14 - Protective cover

- ☐ For top of fuel tank

15 - Flange

- ☐ Right side.
- ☐ Note installation position on fuel tank.

Installation position of left sender flange (fuel tank)





1.5 Assembly overview - fuel filter with fuel cooler

1 - Securing clip

2 - Return line

- ☐ To fuel cooler
- ☐ Blue or with blue marking.
- ☐ Union with marking - RT-.
- ☐ Check for secure seating.
- ☐ To pull off, press release button on connection.

3 - Supply

- ☐ From fuel tank.
- ☐ Black
- ☐ Union with marking - VF-.
- ☐ Check for secure seating.
- ☐ To pull off, press release button on connection.

4 - 10 Nm

5 - Fuel cooler

6 - Coolant hose

- ☐ Coolant hose schematic diagram ⇒ [page 72](#).

7 - Return line

- ☐ To fuel tank.
- ☐ Check for secure seating.
- ☐ To pull off, press release button on connection.

8 - Bracket

- ☐ For fuel filter.

9 - Fuel filter

- ☐ Observe change intervals.
- ☐ Note installation position.

10 - Seal

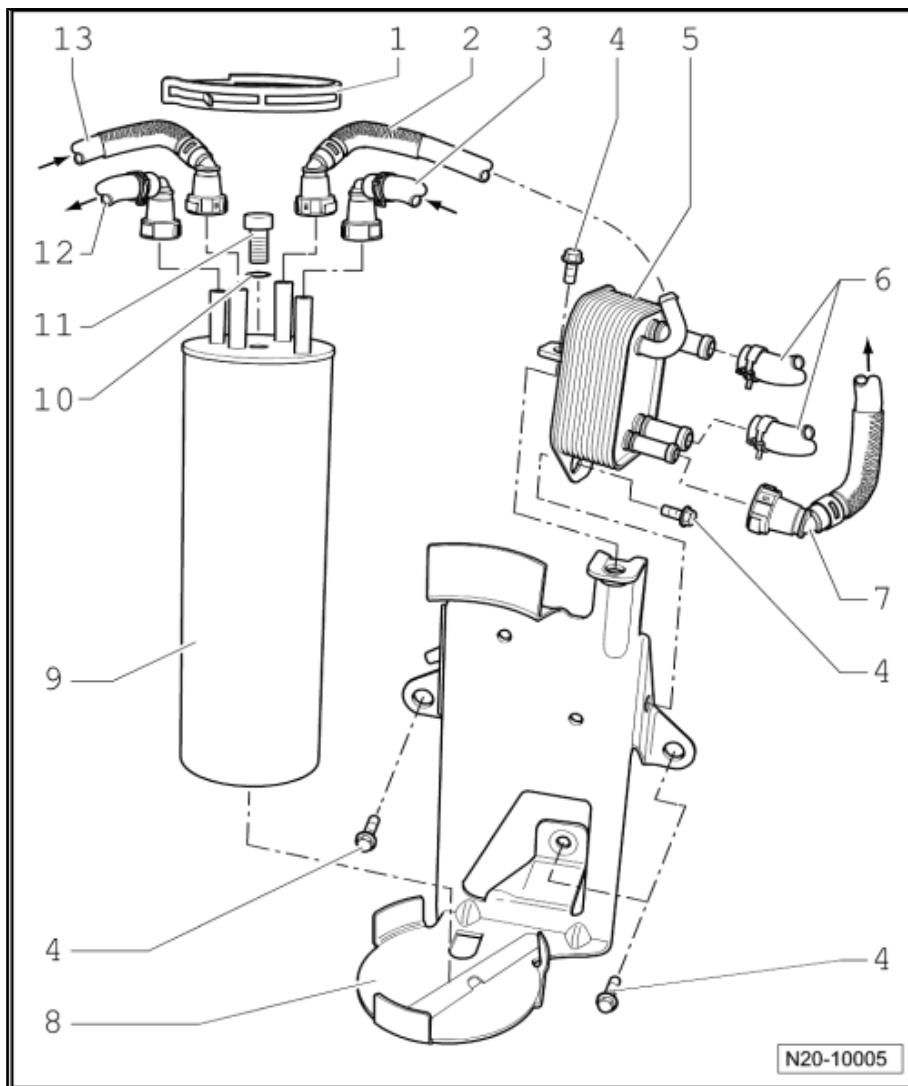
- ☐ Renew.
- ☐ If fitted.

11 - Water drainage connection, 5 Nm

- ☐ If fitted.
- ☐ Unscrew to drain water and extract approx. 100 cm³ using diesel extractor -VAS 5226-.

12 - Supply line

- ☐ To tandem pump.
- ☐ Union with marking -VM-.
- ☐ Check for secure seating.
- ☐ To pull off, press release button on connection.





13 - Return line

- ☐ From fuel rail.
- ☐ Union with marking -RF-.
- ☐ Check for secure seating.
- ☐ To pull off, press release button on connection.

1.6 Emptying fuel tank

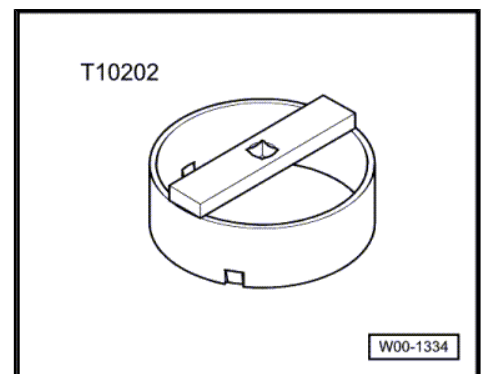
⇒ „1.6.1 Emptying fuel tank when fuel pump is intact“,
page 94

Special tools and workshop equipment required

- ◆ Fuel extractor -VAS 5190-



- ◆ Wrench -T10202-



- ◆ Not illustrated:
- ◆ Assembly tool -T10118-

Procedure

- Note safety precautions before beginning work ⇒ [page 86](#) .
- Open fuel tank filler flap.



- Push suction hose -arrow- of fuel extractor -VAS 5190- approx. 170 ... 180 cm into fuel tank filler neck and extract fuel.



Note

- ♦ *When no more fuel is extracted, the fuel tank is emptied just enough for the sender flanges to be opened without danger. The tank may be removed while containing remaining fuel.*
- ♦ *If work must be performed on fuel pumps or fuel tank senders, proceed as follows:*

Vehicles up to week 47/06

Vehicles from week 48/06 ➔ [page 92](#)

- Fold rear bench seat forwards.
- Cut carpet open from point -A- to point -B- in the pre-cut area -arrows-.

Right side of vehicle

- Remove nuts -1- from cover. If necessary, unscrew backrest mounting -2- or support mounting ➔ General body repairs, interior; Rep. gr. 72 ; Rear seats .

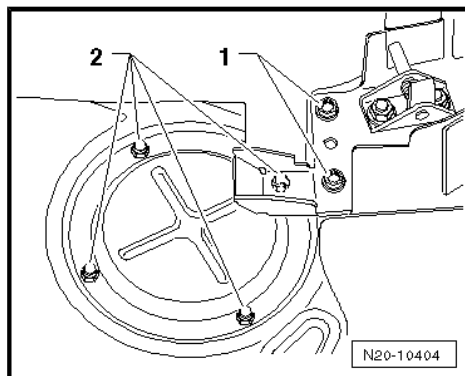
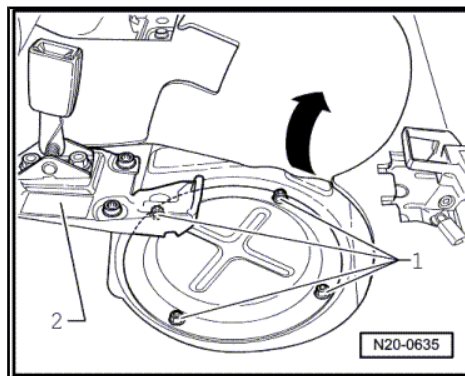
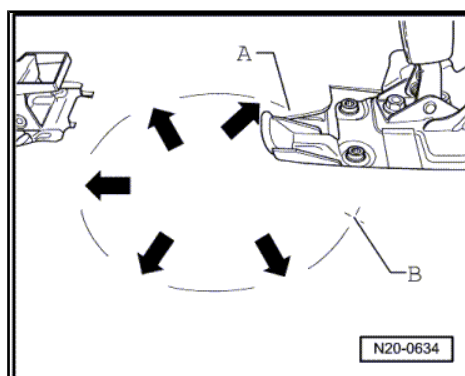
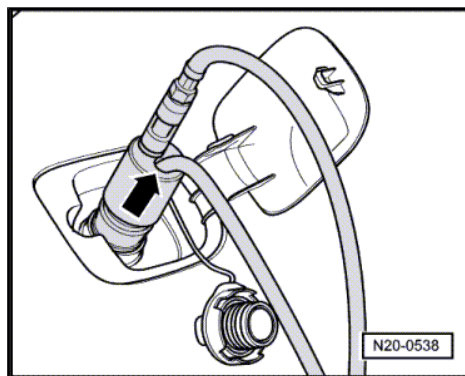
Left side of vehicle

- Remove bolts -1-.

- Then remove nuts -2-, to do this for one nut push mounting bracket slightly upwards.

Vehicles from week 48/06

- Remove rear bench seat ➔ General body repairs, interior; Rep. gr. 72 ; Rear seats; Removing and installing bench seat / individual seats .





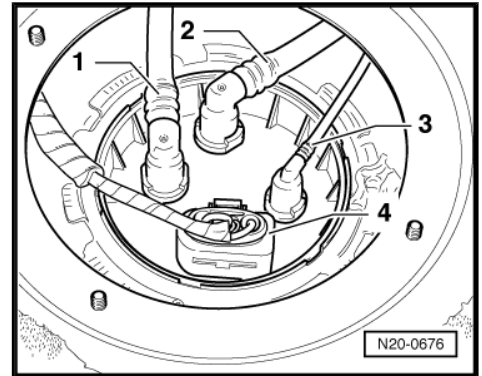
Continuation for all vehicles

- Pull off connectors for fuel pump and fuel gauge sender -4-.
- Pull return line -1-, supply line -2- and, if necessary, the return line for auxiliary heater -3- off right sender flange.



Note

Release connection by pressing button on line coupling.

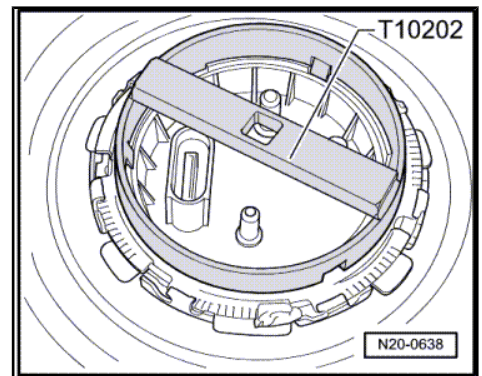


- Now remove locking ring from sender flange using wrench - T10202- .
- Carefully lever out sender flange and raise it slightly.
- Insert suction hose of fuel extractor -VAS 5190- as deeply as possible into right or left side of fuel tank and extract fuel.
- For work on left side of fuel tank, proceed as described above.
- When breather lines are pulled off, buttons of hose couplings sometimes cannot be pressed in. Use assembly tool -T10118- for this.

For further work on inside of fuel tank, sender flanges may remain removed.

If fuel tank needed only to be emptied, install sender flanges again.

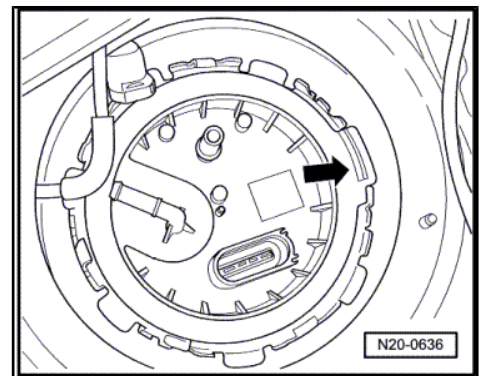
- First check that sender flange seals are properly seated.



Note

Renew seals if the fuel has caused them to swell.

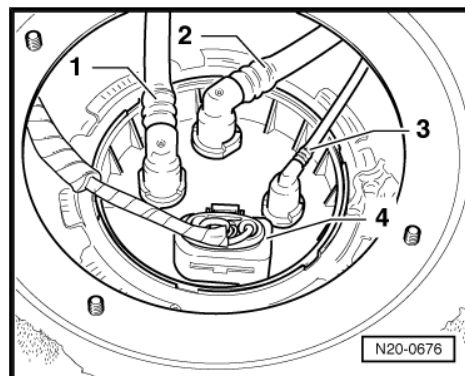
- Insert sender flange with locating tab in direction of travel -arrow-.
- Tighten locking rings on left and right using wrench -T10202- to 145 Nm.





Note

- ◆ Do not interchange supply and return lines (return line -1- blue, supply line -2- black).
- ◆ Ensure that fuel hose connections are tight.



1.6.1 Emptying fuel tank when fuel pump is intact

Special tools and workshop equipment required

- ◆ Vehicle diagnosis tester
- ◆ Fuel extractor -VAS 5190-
- ◆ Adapter for fuel extraction -VAS 5190 /3 -



WARNING

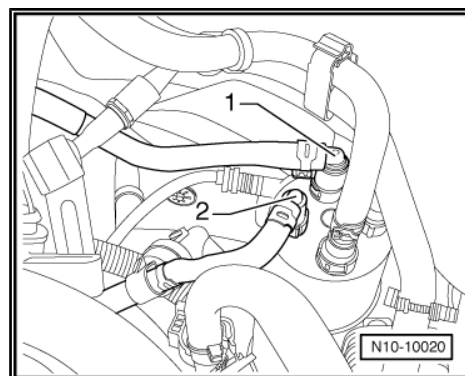
Fuel supply line is pressurised. Wear eye protection and protective clothing to avoid possible injury and skin contact. Before loosening hose connections, wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.



Note

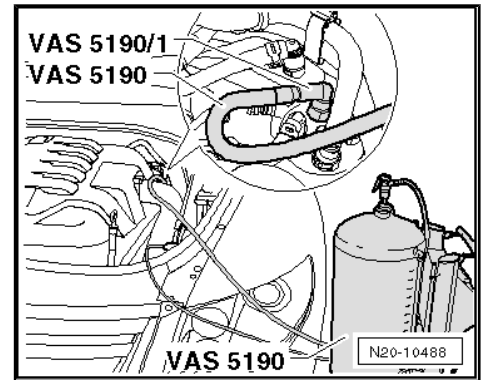
Press in securing ring to release fuel lines.

- Pull off supply line -1- and catch escaping fuel with a cloth.





- Connect fuel extractor -VAS 5190- with adapter for fuel extractor -VAS 5190 /3 - to fuel supply line.



- Connect a diagnosis tester.



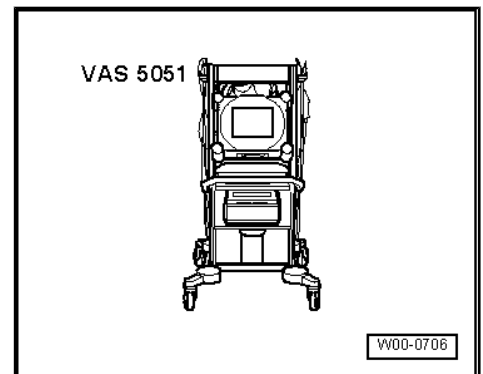
Note

The fuel pump is being activated when engine is not running.

- Switch on ignition.
- Remove filler cap from fuel tank filler neck.
- Perform the function „Bleeding fuel system“ in „guided functions“.

If the fuel tank is emptied, »stop« the function to prevent the fuel pump from running »dry«.

- Operate shut-off tap on fuel extractor -VAS 5190- , until the fuel tank is emptied.



Bleeding fuel system

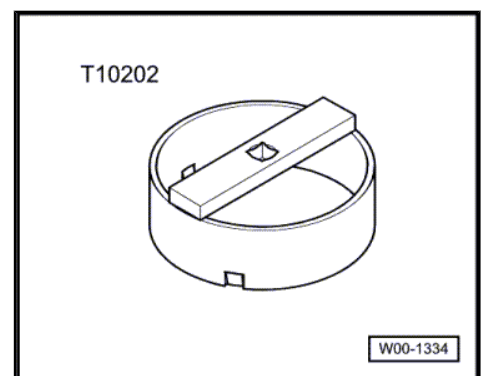
2) Low-pressure section

- Fuel tank filled.
- Connect a diagnosis tester.
- Perform the function „Bleeding fuel system“ in „guided functions“.

1.7 Removing and installing fuel pump unit, fuel gauge sender and suction jet pumps (for vehicles ► model year 08)

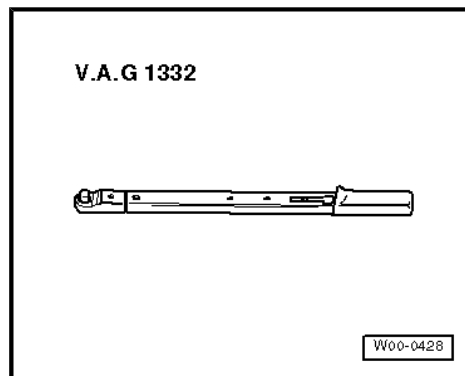
Special tools and workshop equipment required

- ◆ Wrench -T10202-





- ◆ Torque wrench -V.A.G 1332- (40 ... 200 Nm)

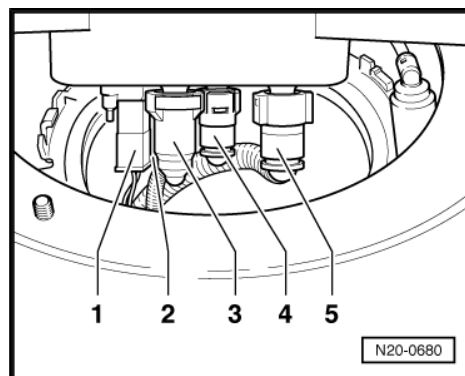


Prerequisites

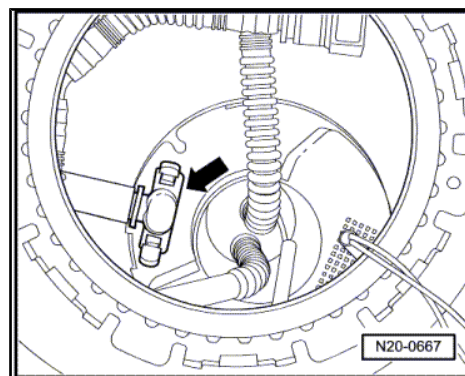
- Fuel tank must be emptied ➔ [page 91](#) , Emptying fuel tank.
- Connectors and wires for left and right-hand sender flanges have been removed.
- Locking rings for left and right sender flanges have been removed.
- Note safety precautions before beginning work ➔ [page 86](#) .

Procedure

- Pull off connectors -1- and -2- as well as hose couplings -3-, -4- and -5- below right sender flange.
- Remove sender flange.



- Unclip black filler hose -arrow- from fuel pump unit housing on left and right sides of fuel tank.



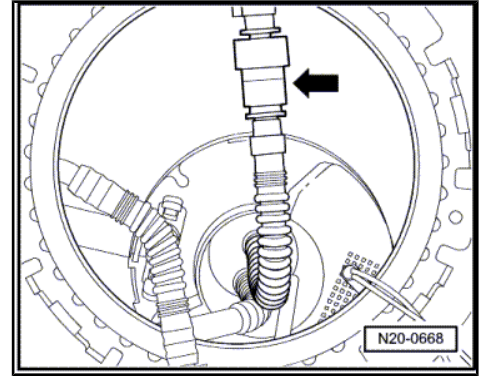


- Pull fuel supply line, to suction-jet pumps, off fuel delivery unit -arrow- on left and right sides of fuel tank.
- Disconnect fuel supply and return lines between the two fuel pump units on the left side of the fuel tank.
- Unscrew fuel delivery unit in bottom of fuel tank by turning approx. 90° to left.



Note

The fuel pump housing is filled with fuel. Fuel may run out if housing is tipped or canted.

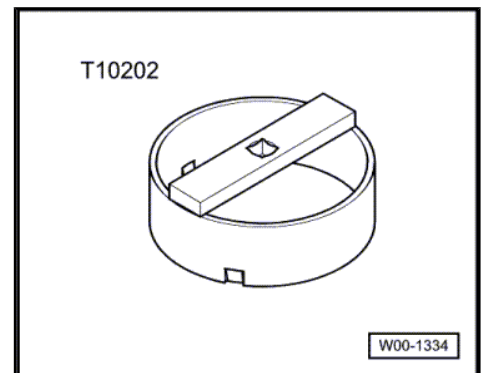


- Now unclip fuel gauge senders on each side of fuel tank and pull them out.
- Now unclip suction-jet pumps from bottom on each side and remove with a slight turn.
- Pull out hose ends through left and right sender openings.

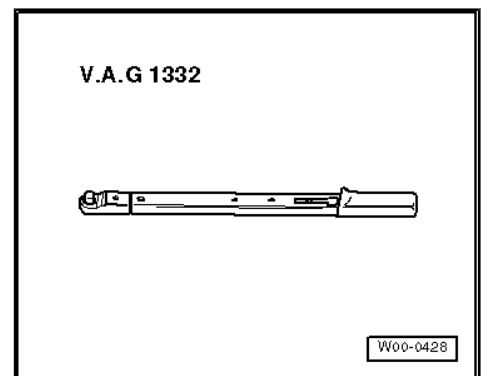
1.8 Removing and installing fuel pump unit, fuel gauge sender and suction jet pumps (for vehicles model year 08 ►)

Special tools and workshop equipment required

- ◆ Wrench -T10202-



- ◆ Torque wrench -V.A.G 1332- (40 ... 200 Nm)



Prerequisites

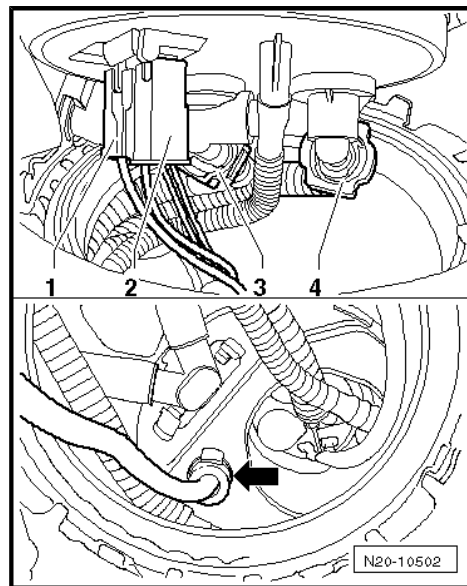
- Fuel tank must be drained.
- Locking rings for left and right sender flanges have been removed.
- Connectors and wires for left and right-hand sender flanges have been removed.



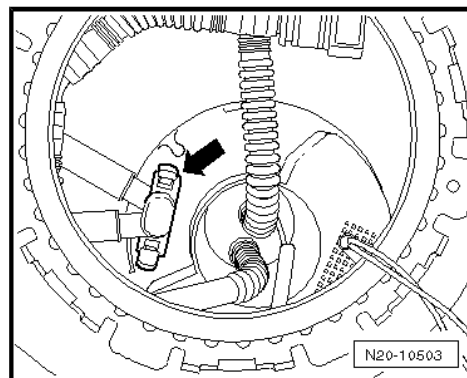
- Observe safety precautions before beginning work.

Procedure for right side.

- Pull off connectors -1- and -2- as well as hose connections -3- and -4- below right sender flange.
- Unclip hose coupling (heater supply) -arrow- from fuel pump unit.
- Remove sender flange.



- Unclip black filler hose connection -arrow- (from suction jet pumps) from fuel pump unit housing.



- Disconnect fuel supply line at fuel pump unit -arrow- (to suction jet pumps on left side of fuel tank).

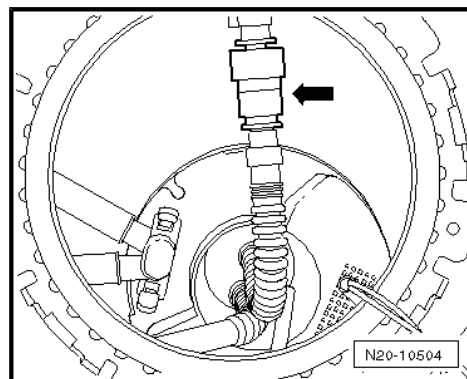


Note

The fuel pump housing is filled with fuel. Fuel may run out if housing is tipped or canted.

- Unscrew fuel delivery unit in bottom of fuel tank by turning approx. 90° to left ➔ [Item 12 \(page 89\)](#).

3) Fuel pump unit remains in fuel tank to exchange fuel gauge sender.

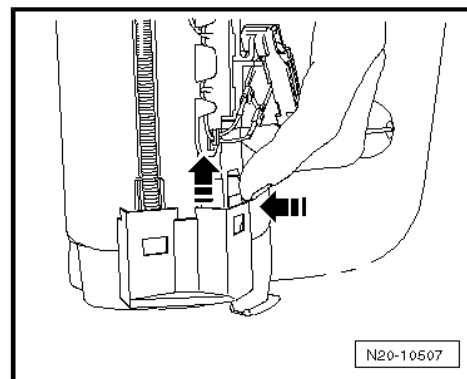




- Now unclip fuel gauge sender on right side -arrow- of fuel tank and remove upwards.
- Install in reverse order.

Procedure for left side.

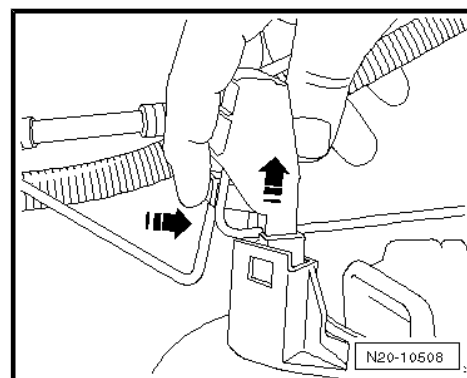
- Unclip and remove fuel gauge sender on left side of fuel tank.



- On left side of fuel tank, now unclip bracket for suction jet pump -arrow- ⇒ [Item 6 \(page 88\)](#) .

Pull suction-jet pumps together with supply/filler hoses and fuel lines for suction-jet pumps out of left opening of fuel tank.

- Install in reverse order.

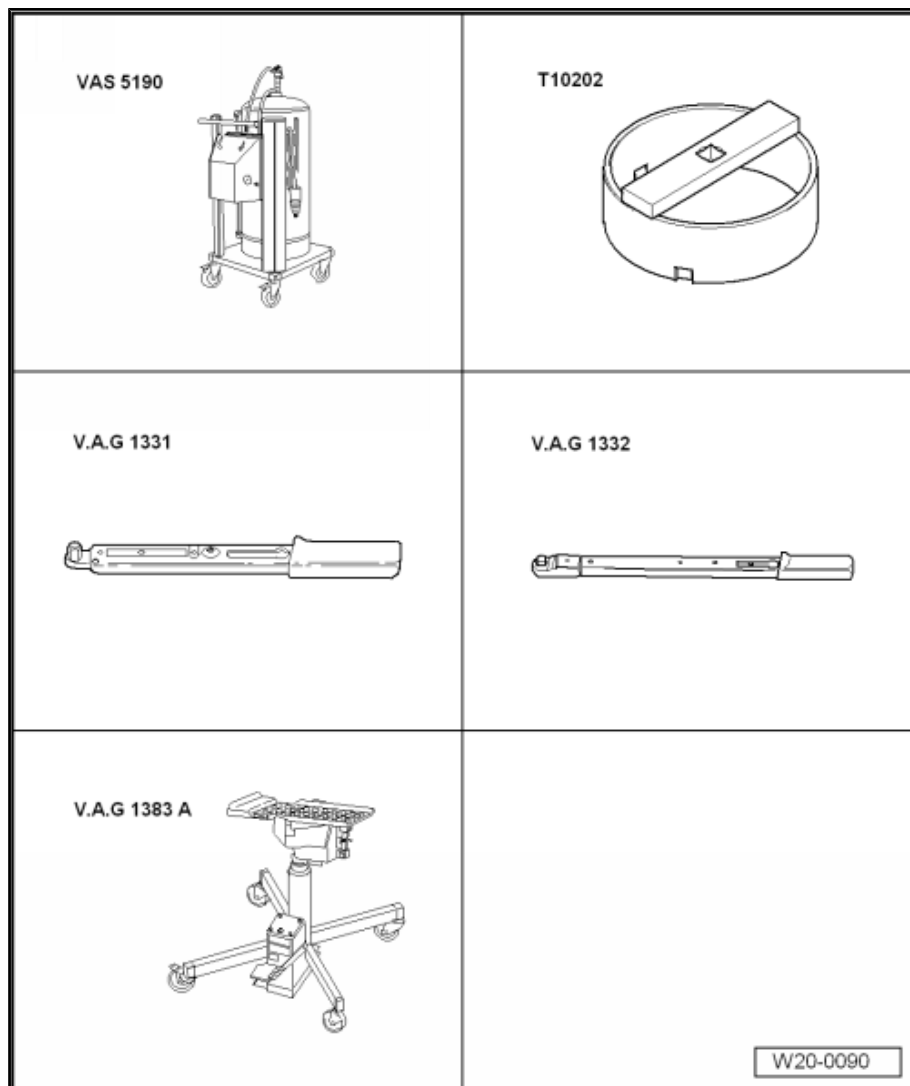




1.9 Removing and installing fuel tank with attached components

Special tools and workshop equipment required

- ◆ Fuel extractor -VAS 5190-
- ◆ Wrench -T10202-
- ◆ Torque wrench (5 ... 50 Nm) -V.A.G 1331-
- ◆ Torque wrench (40 ... 200 Nm) -V.A.G 1332-
- ◆ Engine and gearbox jack - V.A.G 1383/A-



Prerequisites

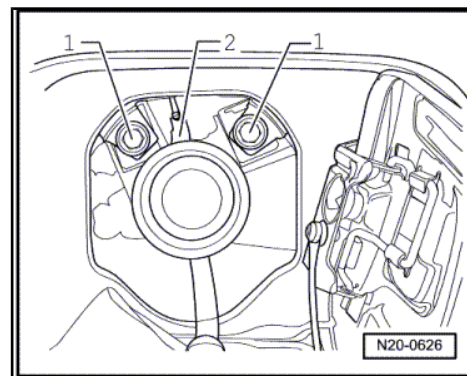
Fuel tank must be empty ⇒ „1.6 Emptying fuel tank“, page 91 .

1.9.1 Removing

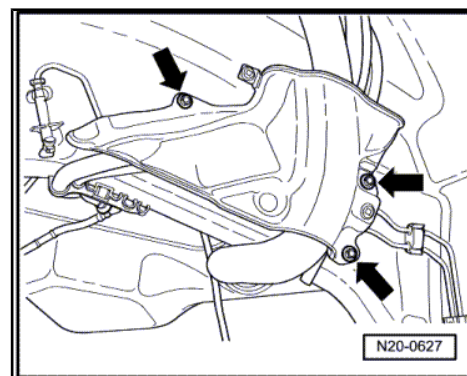
- Note safety precautions before beginning work ⇒ page 86 .
- Observe rules for cleanliness ⇒ page 85 .
- Remove Silencer with mountings.
- Remove rear propshaft ⇒ Transfer box and final drive; Rep. gr. 39 ; Removing and installing propshaft .
- Remove rear axle ⇒ Running gear, axles, steering; Rep. gr. 42 ; Repairing rear axle .
- Open fuel flap and remove fuel tank cap.
- Pull rubber gasket off fuel tank filler neck.



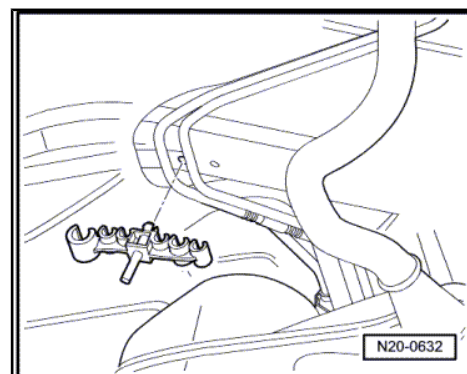
- Remove securing bolts -1- on filler neck and pull off earth wire -2-.
- Remove rear right wheel housing liner ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liner; Removing and installing wheel housing liner .



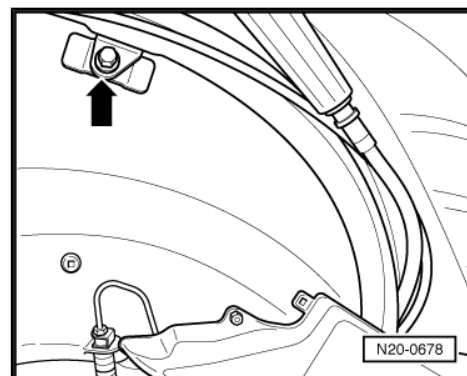
- Unbolt cover plate -arrows-.



- Unclip fuel tank breather lines attached to longitudinal member.



- Remove securing bolt for filler neck -arrow- in wheel housing.





- Disconnect connector to fuel pump on left next to fuel tank.
- Now remove securing straps to left and right with cover below fuel tank.
- Support fuel tank using engine and gearbox jack - V.A.G 1383 A- and remove securing strap in middle of fuel tank.
- Carefully lower fuel tank about 30 cm.
- Reach between fuel tank and vehicle underbody and pull fuel line off sender flange, while holding a cloth around supply line.



Note

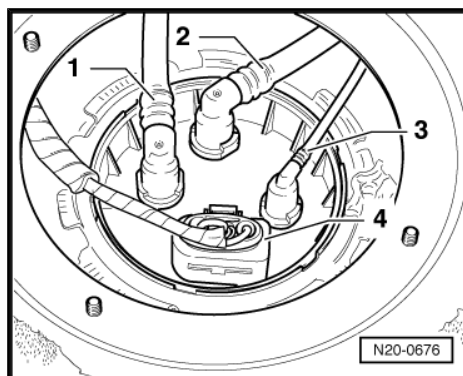
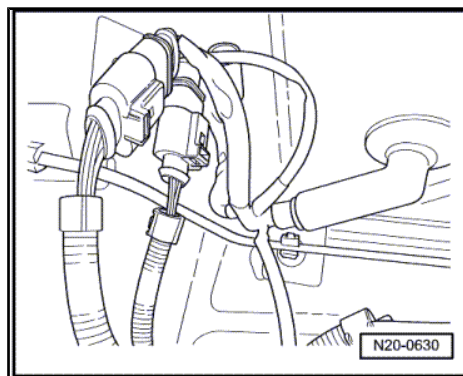
This step saves cutting carpet in vehicle interior in vicinity of sender flange.

- Lower fuel tank.

1.9.2 Installing

Installation is carried out in the reverse order. When installing, note the following:

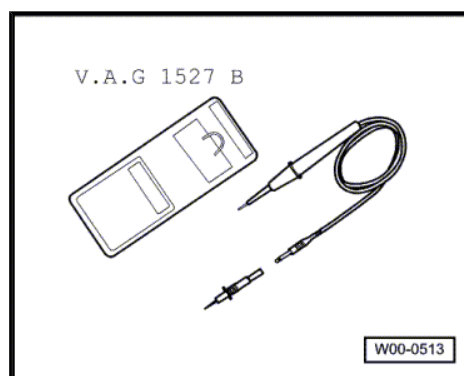
- ◆ Do not interchange supply and return hose (return line -1- blue or blue markings, supply line -2- black).
- ◆ Connections for breather and fuel lines must engage audibly when joined.
- ◆ Clip fuel lines onto fuel tank.
- ◆ Install breather and fuel hoses free of kinks.
- ◆ Ensure that fuel hose connections are tight.



1.10 Checking fuel pumps

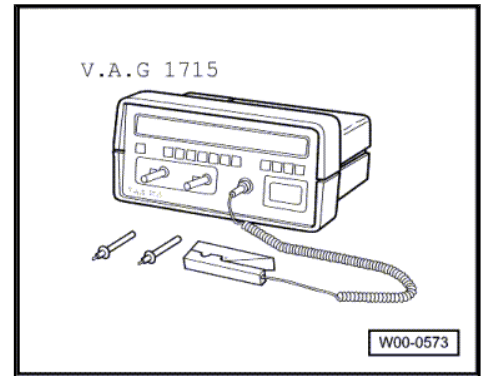
Special tools and workshop equipment required

- ◆ Voltage tester -V.A.G 1527 B-





- ◆ Hand multimeter -V.A.G 1526 C- or multimeter -V.A.G 1715-



Not illustrated:

- ◆ Auxiliary measuring set -V.A.G 1594 C-

Test prerequisites

- Fuses must be OK
- The battery voltage must be at least 11.5 V
- All electrical consumers, e.g. lights and rear window heating, are switched off.

Checking function and voltage supply

- Fold rear bench seat forwards.
- Briefly operate starter. Fuel pumps must be heard to start running.
- Switch off ignition.

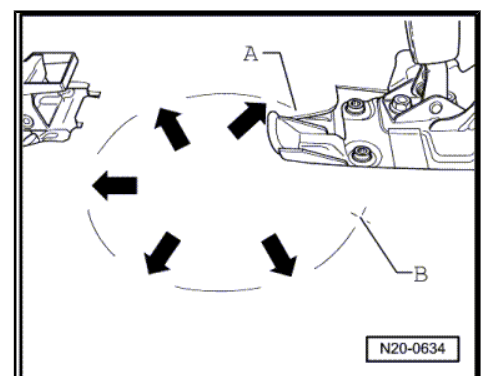
If the fuel pump does not start:

Vehicles up to week 47/06

Vehicles from week 48, 2006 ⇒ [page 104](#)

- Cut carpet open from point -A- to point -B- in the pre-cut area -arrows-.

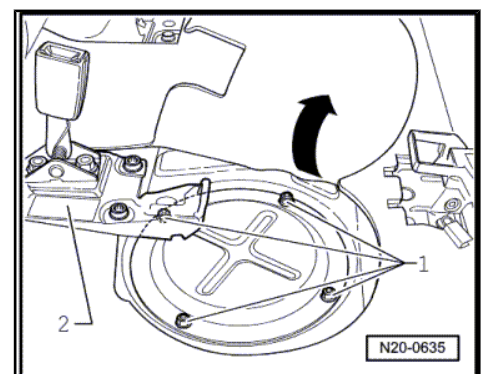
Right side of vehicle



- Unscrew nuts -1- from cover. If necessary, unscrew backrest mounting -2- or support mounting: ⇒ General body repairs, interior; Rep. gr. 72 ; Rear seats; Removing and installing bench seat / individual seats .

Left side of vehicle

- Remove bolts -1-.





- Then remove nuts -2-, to do this for one nut push mounting bracket slightly upwards.

Vehicles from week 48, 2006

- Remove rear bench seat ⇒ General body repairs, interior; Rep. gr. 72 ; Rear seats; Removing and installing bench seat / individual seats .

Continuation for all vehicles

Check voltage supply of each fuel pump separately as follows:

- Pull connector off right flange of fuel delivery unit.
- Connect voltage tester -V.A.G 1527 B- to outer contacts of connector using auxiliary cables from auxiliary measuring set -V.A.G 1594 C- .
- Switch on ignition; LED must light up for approx. 2 seconds.

If LED does not light up

- Check activation of fuel pump relay and wiring for open circuit and short circuit ⇒ Vehicle diagnostic tester.

LED lights up (voltage supply OK):

- Remove right-hand fuel delivery unit ⇒ [page 95](#) .
- Check that electrical wiring between flange and fuel pump is connected and has continuity.

If no open circuit can be found:

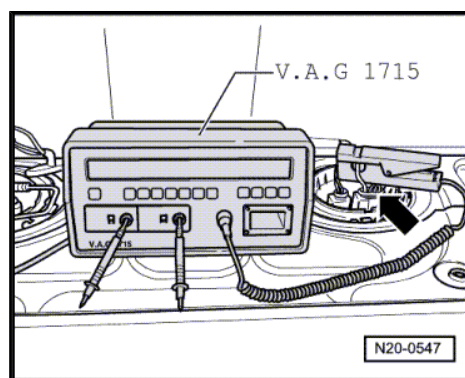
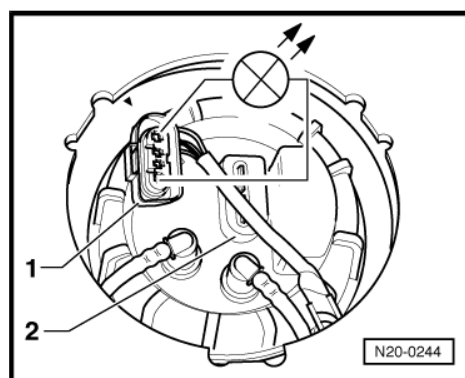
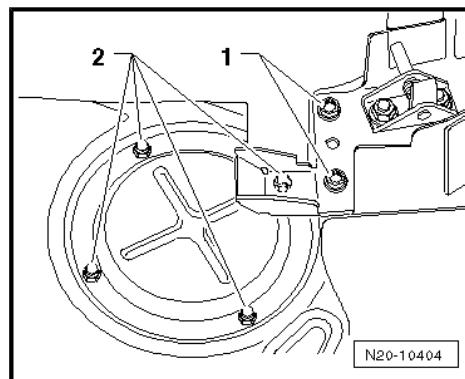
- Right-hand fuel pump is defective, renew fuel delivery unit ⇒ [page 95](#) .
- Repeat check on left fuel pump unit.

Checking current draw of fuel pumps

- Check current draw of each fuel pump separately as follows:
- Connect current pick-up of multimeter -V.A.G 1715- to line of contact 1 -arrow- of 4-pin connector of wiring harness to right fuel pump unit.
- Start engine and run at idling speed.
- Measure current draw of fuel pump. Specification: max. 8 Amperes.

If current draw is exceeded:

- Right-hand fuel pump is defective, renew fuel delivery unit ⇒ [page 95](#) .
- Repeat check on left fuel pump unit.



1.11 Checking tandem pump

⇒ „1.11.1 Checking delivery pressure“, [page 104](#)

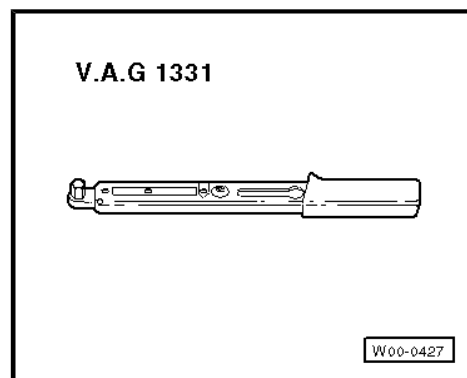
⇒ „1.11.2 Checking for internal leaks“, [page 106](#)

1.11.1 Checking delivery pressure

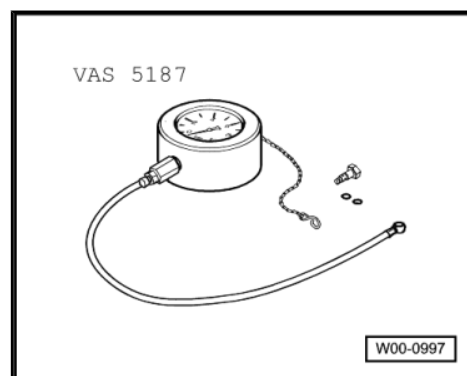
Special tools and workshop equipment required



- ◆ Torque wrench -V.A.G 1331- (5 ... 50 Nm)



- ◆ Tandem pump tester -VAS 5187-



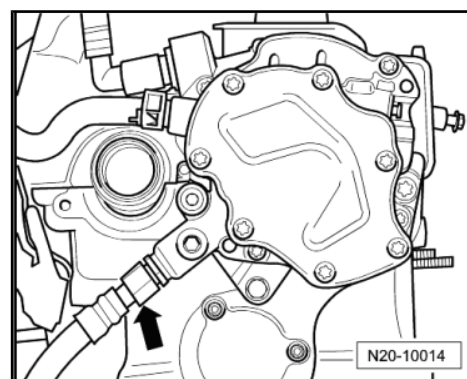
- ◆ Vehicle diagnosis, testing and information system -VAS 5051B-
- ◆ Diagnosis cable -VAS 5051/1- or -VAS 5051/3-

Test prerequisites

- Coolant temperature must be at least 85 °C.
- Unit injectors OK.
- Intact fuel pump unit
- Fuel filter and fuel lines must not be blocked.

Procedure

- Disconnect supply line -arrow- from tandem pump.





- Connect tandem pump tester -VAS 5187- as shown.



Note

Two versions of tandem pump tester -VAS 5187- are in use. In older version adapter -VAS 5187/6-3- must be used as shown.

- Start engine and run at idling speed.
- Connect vehicle diagnosis, testing and information system - VAS 5051B- and select operating mode „vehicle self-diagnosis“. Then select engine electronics control unit with the Address word „01“.
- Press diagnosis function „08-Read measured value block“.
- Enter display group „1“ using number block (key pad) and confirm entry with button.
- Read off engine idling speed in display zone 1.
- Increase engine speed to 1500 rpm.
- Observe pressure indicated on pressure gauge. Specification: min. 7.5 bar.
- Press button .
- Select „06-End output“ function.

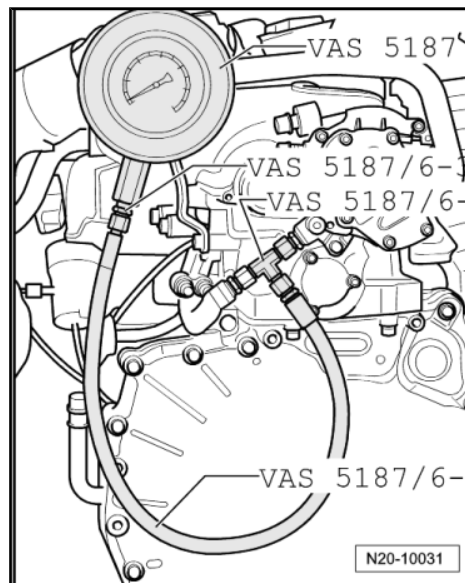
If the specification is not attained:

- Renew tandem pump ⇒ [page 107](#) , Removing and installing tandem pump.



Note

After removing pressure tester, tighten supply line to 27 Nm.



1.11.2 Checking for internal leaks

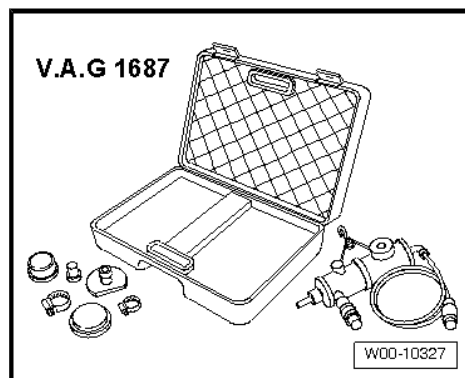


Note

The tandem pump must be checked for internal leaks between fuel side and oil side after reinstalling a used tandem pump, e.g. after renewing or repairing a cylinder head and/or when installing a "short" engine. When leaking it is possible for the fuel to mix with the oil which may cause damage to the engine.

Special tools and workshop equipment required

- ♦ Charge air system tester -V.A.G 1687-





Procedure

- Pull fuel supply hose (white marking) and fuel return hose (blue marking) off tandem pump.
- Seal fuel return union on tandem pump with a plug. Secure sealing plug with a spring-type clip.

Prepare charge air system tester -V.A.G 1687- as follows:

- Turn pressure regulating valve -2- anti-clockwise onto stop.
- Close valves -3- and -4-.
- Connect test connection -5- to fuel supply union of tandem pump using a commercially available compressed air connection and a section of fuel hose. Use a spring-type clip to secure.



Note

To turn the pressure regulating valve -2- the knob must be pulled upwards.

- Connect compressed air hose -1- (compressed air source) to charge air system tester -V.A.G 1687-.



Note

If there is water in the sight glass, drain at water drain screw -6-.

- Open valve -3-.
- Adjust pressure to 1.0 bar with pressure regulating valve -2-.



Caution

The maximum test pressure is 1.3 bar and this must not be exceeded.

- Open valve -4- and wait until the test circuit is filled. If necessary readjust pressure to 1.0 bar.
- Close valve -3- to retain pressure and observe the pressure drop over a period of 1 minute.

If the pressure does not drop the tandem pump can be reused, if the pressure drops the tandem pump must be renewed.

1.12 Removing and installing tandem pump

⇒ „1.12.1 Removing“, page 108

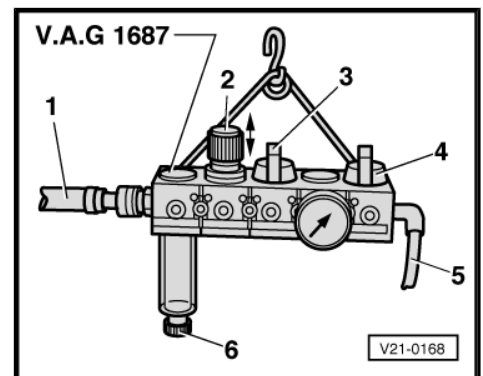
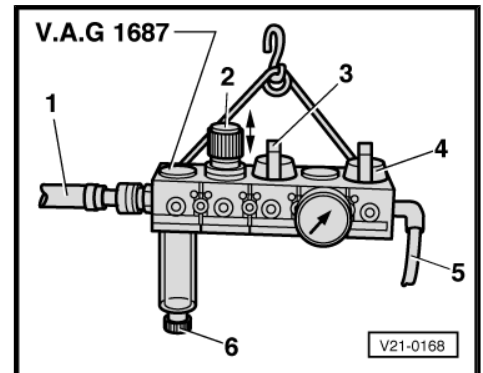
⇒ „1.12.2 Installing“, page 108



DANGER!

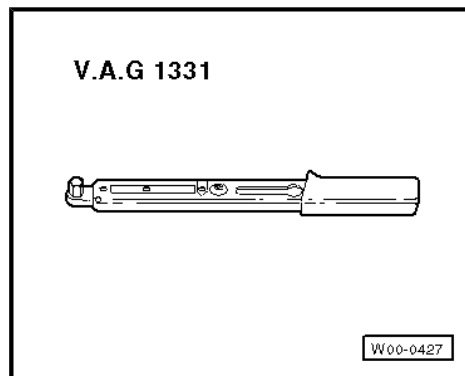
The tandem pump may, under no circumstances, be dismantled as the vacuum part could otherwise malfunction. This would result in the failure of the brake servo.

Special tools and workshop equipment required

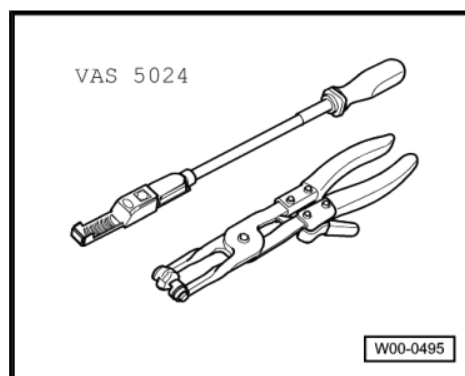




- ◆ Torque wrench -V.A.G 1331- (5 ... 50 Nm)



- ◆ Spring-type clip pliers -VAS 5024-



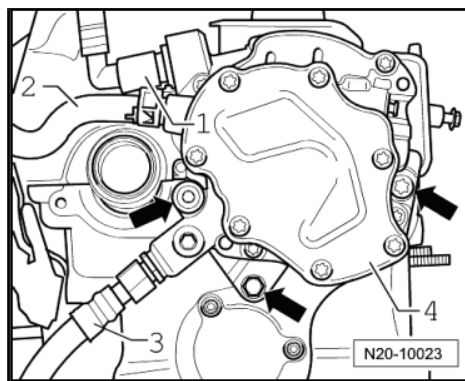
1.12.1 Removing



Note

The removal and installation of the tandem pump can only be undertaken when the engine is removed due to the cramped conditions.

- Remove engine and gearbox ➔ [page 5](#) .
- Pull vacuum line -1- from brake servo off tandem pump -4-.
- Pull fuel line -2- off tandem pump -4-.
- Disconnect fuel line -3- from tandem pump -4-.
- Remove securing bolts -arrows-.
- Remove tandem pump -4- from cylinder head.



1.12.2 Installing

Installation is carried out in the reverse order. When installing, note the following:

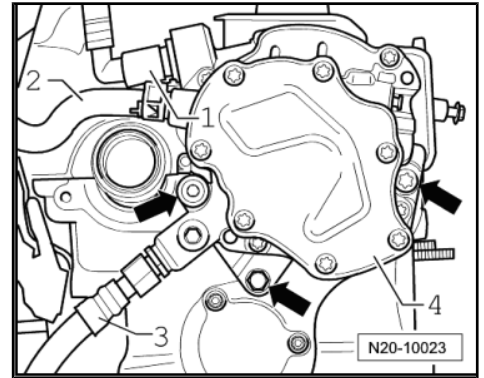


Note

- ◆ Ensure proper seating of tandem pump coupling in the shaft.
- ◆ Always renew tandem pump seals.



- Install tandem pump and tighten securing bolts -arrows-. Specified torque M 6: 8 Nm, M 8: 20 Nm
- Attach fuel hose -2- and vacuum hose -1- to tandem pump.
- Connect fuel line -3- to tandem pump -4- and tighten fuel line to 27 Nm.
- Install engine and gearbox ➔ [page 5](#) .
- Carry out a road test and read event memory ➔ [page 139](#)
Reading and clearing event memory of engine control unit.



1.13 Assembly overview - accelerator mechanism

1 - Bearing bracket

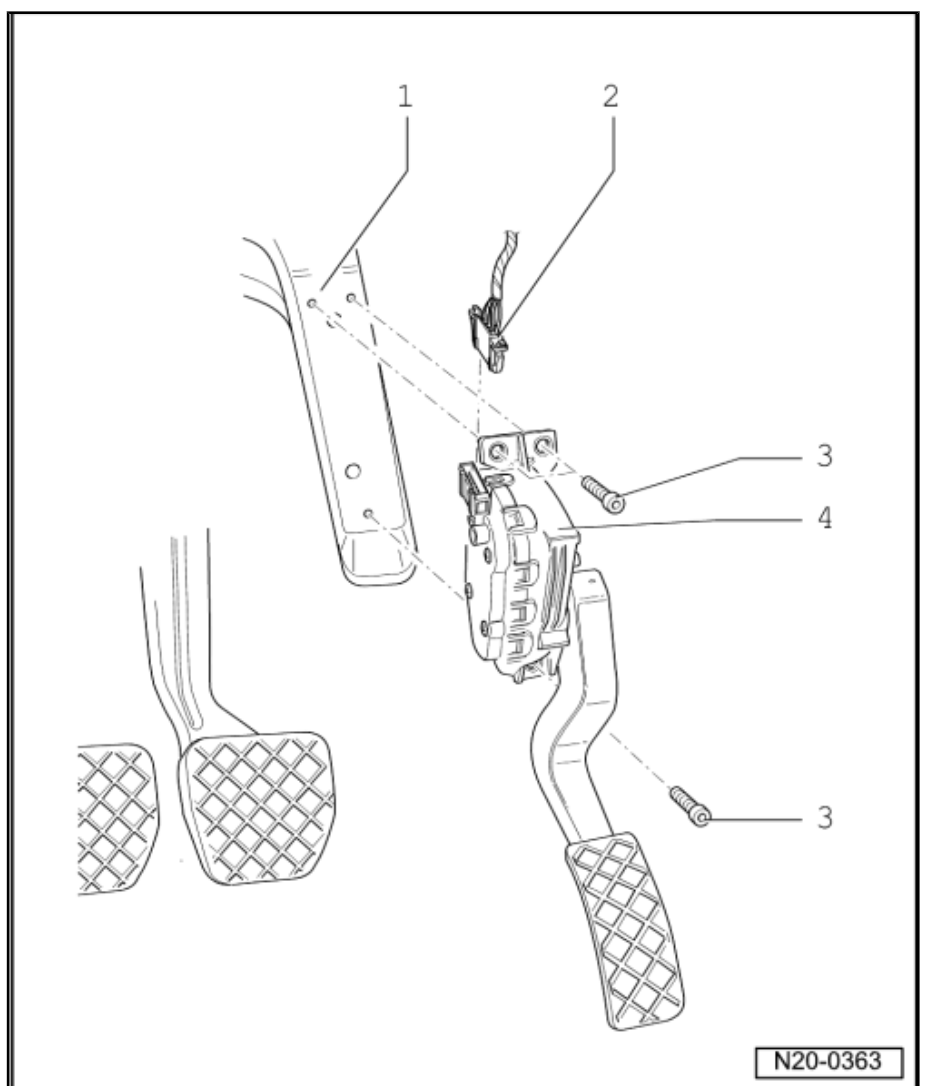
2 - Connector

- ☐ Black, 6-pin.

3 - 10 Nm

4 - Accelerator position sender -G79-

- ☐ Not adjustable.
- ☐ The accelerator position sender passes the position of the accelerator on to the engine control unit.
- ☐ Remove footwell cover to remove sender.





21 – Turbocharging/supercharging

1 Charge air system with turbocharger

⇒ „1.1 Rules for cleanliness“, page 110

⇒ „1.2 Turbocharger with attachments for engine codes BAC and BLK“, page 110

⇒ „1.3 Removing and installing turbocharger for engine codes BAC and BLK“, page 112

⇒ „1.4 Turbocharger with attachments (engine codes BPD and BPE)“, page 114

⇒ „1.5 Removing and installing turbocharger (engine codes BPD and BPE)“, page 116

⇒ „1.6 Removing and installing parts of charge air cooling“, page 120 .

⇒ „1.7 Checking charge air system for leaks“, page 121 .

⇒ „1.8 Hose connections“, page 123

⇒ „1.9 Vacuum hose schematic diagram“, page 125

1.1 Rules for cleanliness

When working on the turbocharger, pay careful attention to the following „5 rules“ for cleanliness:

- ◆ Thoroughly clean all unions and surrounding areas before disconnecting.
- ◆ Place removed parts on a clean surface and cover. Use only lint-free cloths.
- ◆ Carefully cover opened components or seal if repairs cannot be carried out immediately.
- ◆ Install clean components only. Do not remove replacement parts from packing until immediately before installing. Do not use parts that have not been stored in their packing (e.g. in tool boxes etc.).

1.2 Turbocharger with attachments for engine codes BAC and BLK

Observe rules for cleanliness ⇒ [page 110](#) .



Note

- ◆ All hose connections are secured with clamps or retaining clips.
- ◆ Charge air system must be free of leaks.
- ◆ Renew self-locking nuts.
- ◆ After installing turbocharger run engine for approx. 1 minute at idling speed, do not rev engine. This ensures that the turbocharger/compressor is adequately lubricated.

1 - Connecting pipe

- ☐ For exhaust gas recirculation.

2 - 10 Nm

3 - Connecting clamp, 8 Nm

4 - Bracket/lifting eye

5 - Gasket

- ☐ Renew.
- ☐ Note installation position.

6 - 25 Nm

7 - Exhaust manifold

- ☐ To remove, remove exhaust gas recirculation cooler
⇒ [Item 20 \(page 111\)](#)
and unscrew securing bolts securing turbocharger to exhaust manifold
⇒ [Item 6 \(page 111\)](#).

8 - Connecting hose

- ☐ From air filter.

9 - Vacuum line

10 - Cylinder block

11 - 40 Nm

12 - Gasket

- ☐ Renew.

13 - Turbocharger

14 - Bracket

15 - 40 Nm

16 - Connecting clamp, 8 Nm

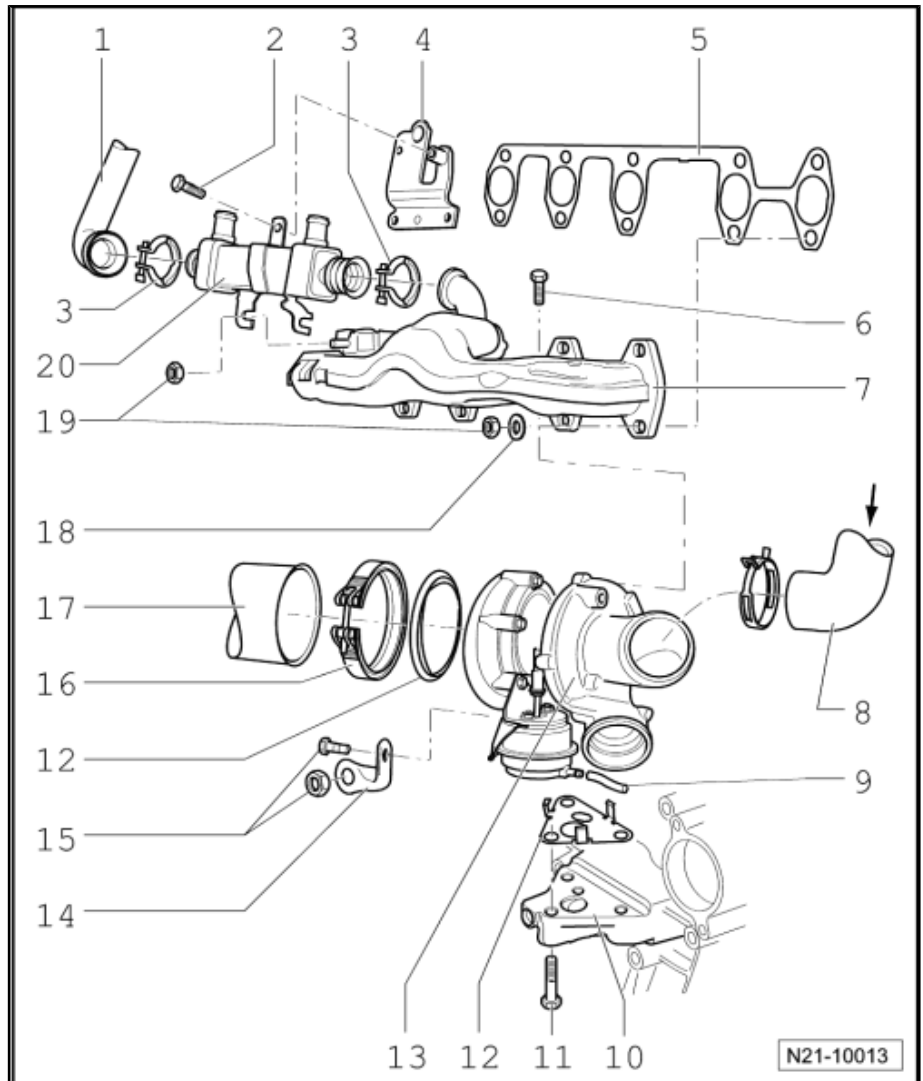
- ☐ For front exhaust pipe
- ☐ Renew.

17 - Front exhaust pipe

18 - Washer

- ☐ Renew.

19 - 25 Nm





20 - Exhaust gas recirculation cooler

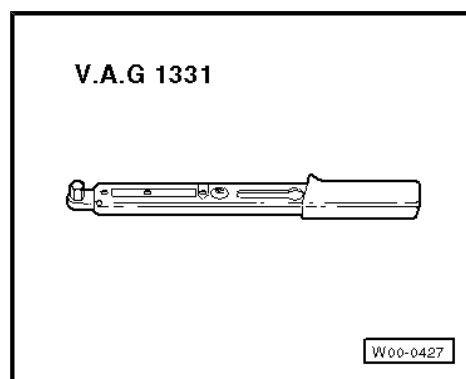
- ☐ Vehicles with automatic gearbox and exhaust gas recirculation changeover valve.

1.3 Removing and installing turbocharger for engine codes BAC and BLK

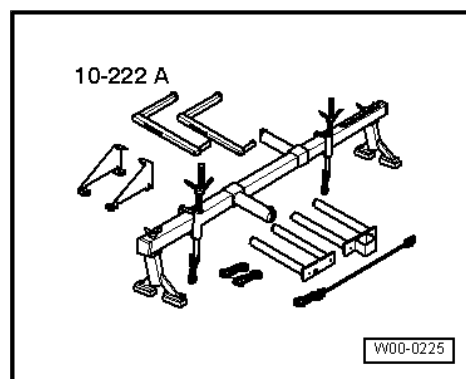
Observe rules for cleanliness ⇒ [page 110](#) .

Special tools and workshop equipment required

- ◆ Torque wrench -V.A.G 1331-



- ◆ Support bracket -10-222A-



Not illustrated

- ◆ Lifting tackle -2024 A/02-
- ◆ Adapter -10-222A/03-
- ◆ Adapter -10-222A/18-
- ◆ Adapter -10-222A/19-



Caution

When a mechanical fault is found on the turbocharger, e.g. a destroyed compressor impeller, it is not only sufficient to renew the turbocharger. To avoid subsequent damage, the following work must be carried out:

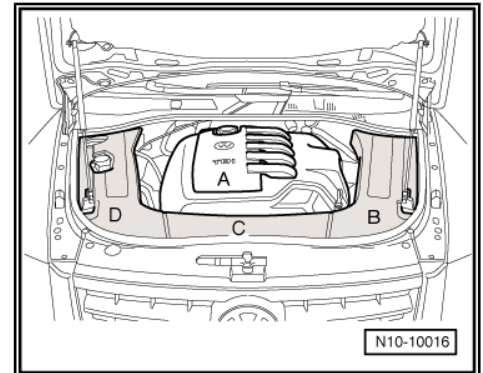
- ◆ *Check air filter housing, air filter element and intake hoses for soiling.*
- ◆ *Check complete charged air routing and charge air cooler for foreign objects.*

If foreign objects are found in the charge air system, the charged air routing must be cleaned and the charge air cooler must be renewed, if necessary.

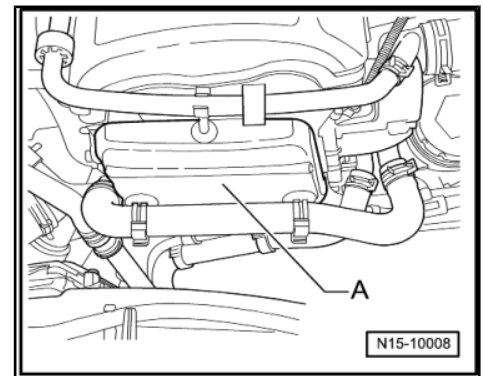


Removing

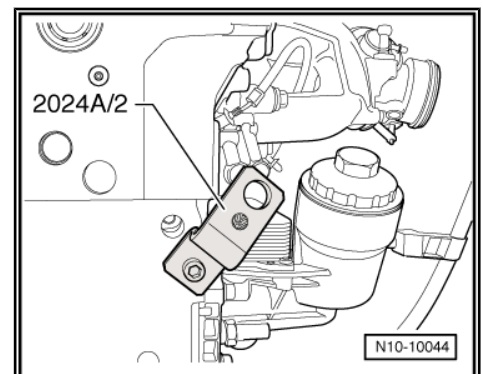
- Remove engine cover -A- and engine compartment covers -B-, -C- and -D-, if fitted.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Assembly overview - noise insulation .
- Remove air filter housing ⇒ [page 138](#) .
- Loosen charge air pipe and vacuum line from turbocharger.
- Loosen exhaust pipe and starter catalytic converter from turbocharger and gearbox ⇒ [page 145](#) .



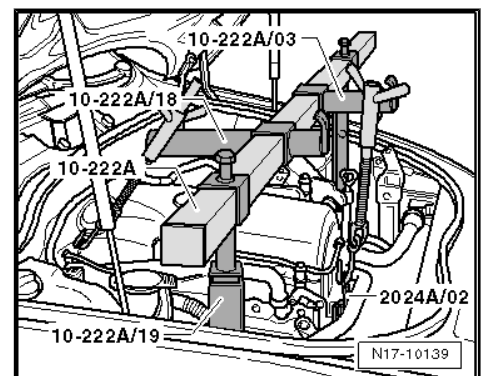
- Remove noise insulation -A-.



- Fit lifting tackle -2024A/2- on cylinder block as shown.
- Support bonnet with suitable workshop equipment.

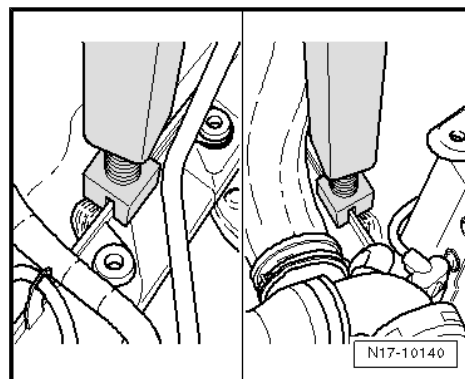


- Fit support bracket -10-222A- .

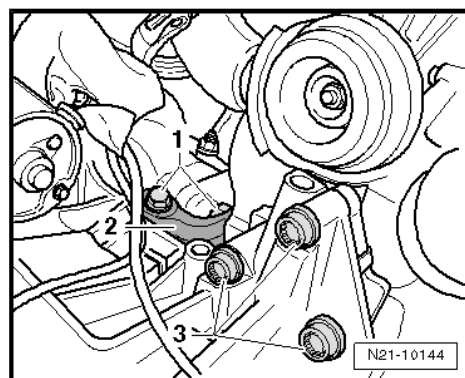




- Observe mounting points on longitudinal members.
- Remove right assembly mounting from engine ⇒ [page 18](#) .
- Unscrew bolts -3- from turbocharger.



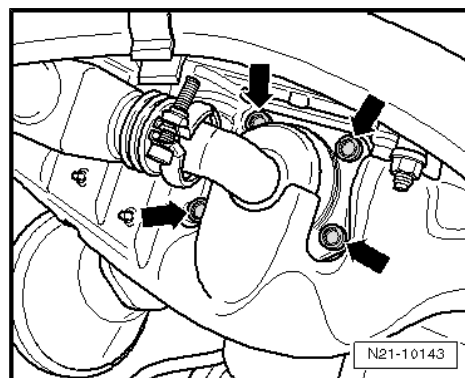
- Unscrew bolts -1- and remove bracket -2-.



- Remove bolts -arrows- from turbocharger.
- Remove turbocharger.

Installing

- Installation is performed in the reverse sequence.



1.4 Turbocharger with attachments (engine codes BPD and BPE)

Observe rules for cleanliness ⇒ [page 110](#) .



i Note

- ◆ All hose connections are secured with clamps or retaining clips.
- ◆ Charge air system must be free of leaks.
- ◆ Renew self-locking nuts.
- ◆ After installing turbocharger run engine for approx. 1 minute at idling speed, do not rev engine. This ensures that the turbocharger/compressor is adequately lubricated.

1 - Bracket

2 - Exhaust gas recirculation cooler

- ☐ Removing and installing
⇒ [page 157](#).

3 - Gasket

- ☐ Renew.

4 - Exhaust gas temperature sender 1 -G235-

- ☐ 45 Nm
- ☐ Lubricate thread of sender using high-temperature paste -G 052 112 A3-.

5 - 40 Nm + turn 90° further

- ☐ Renew.
- ☐ Qty. 3
- ☐ Do not grease

6 - Washers

- ☐ Qty. 3

7 - Gasket

- ☐ Renew.
- ☐ Note installation position.

8 - Exhaust manifold

- ☐ To remove, remove exhaust gas recirculation cooler and remove turbocharger to exhaust manifold securing bolts
⇒ [Item 5 \(page 115\)](#).

9 - 25 Nm

- ☐ Renew.

10 - Flange upper part

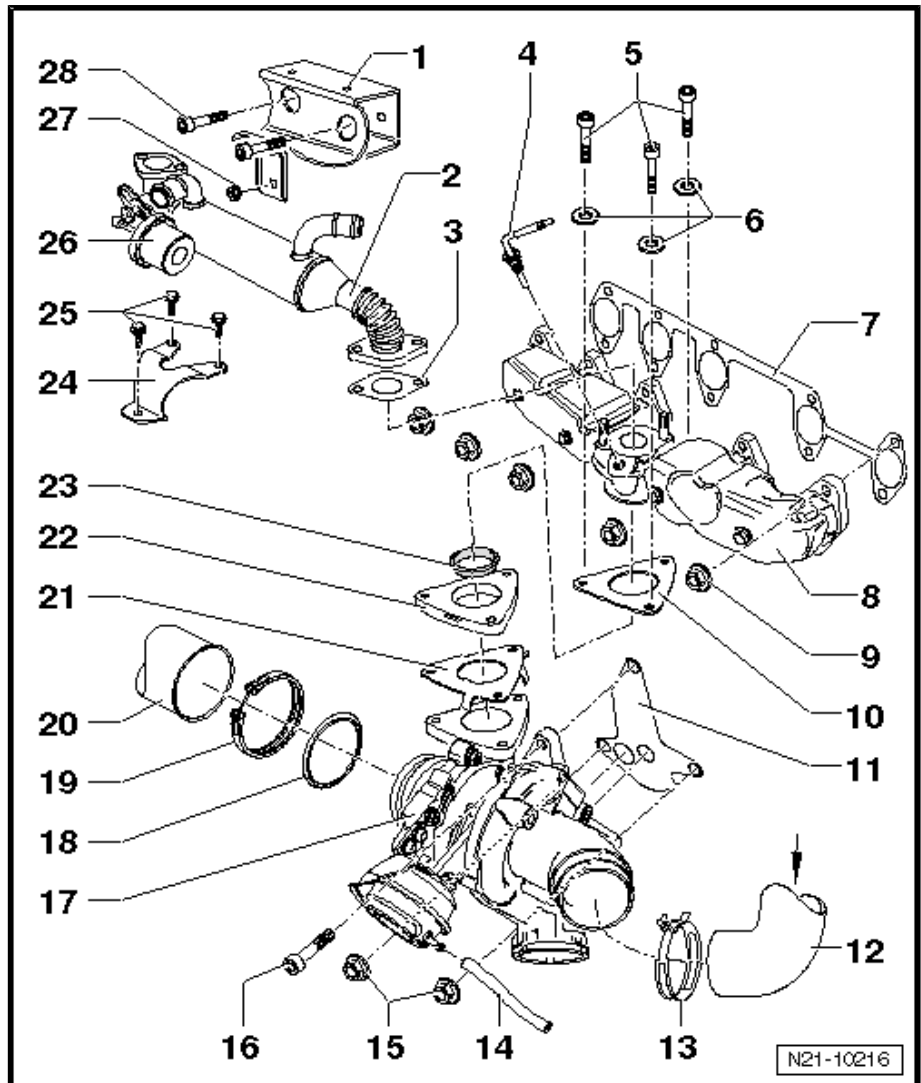
- ☐ Renew.
- ☐ Note installation position.

11 - Gasket

- ☐ Renew.

12 - Connecting hose

- ☐ From air filter.





13 - Clip

14 - Vacuum line

15 - 40 Nm + turn 90° further

16 - 40 Nm + turn 90° further

17 - Turbocharger

- ☐ Removing and installing ⇒ [page 116](#)

18 - Gasket

- ☐ Renew.
- ☐ Note installation position.

19 - Clamp, 7 Nm

- ☐ Renew.

20 - Particulate filter

21 - Gasket

- ☐ Renew.
- ☐ Note installation position.

22 - Flange lower part

- ☐ Renew.

23 - Gasket

- ☐ Renew.
- ☐ Note installation position.

24 - Bracket upper part

25 - 8 Nm

26 - Vacuum actuator

- ☐ For bypass flap.
- ☐ Renew only together with exhaust gas recirculation cooler

27 - 8 Nm

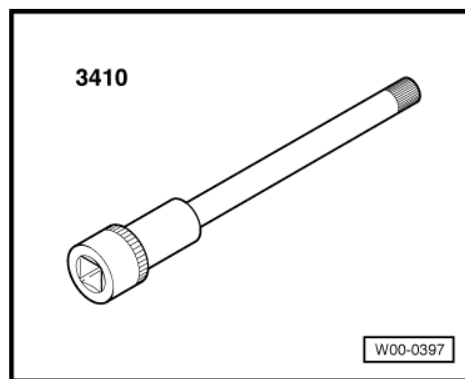
28 - 15 Nm

1.5 Removing and installing turbocharger (engine codes BPD and BPE)

Observe rules for cleanliness ⇒ [page 110](#) .

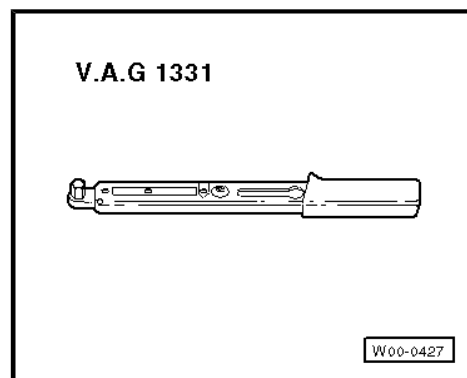
Special tools and workshop equipment required

- ♦ Allen key, long reach -VAS 3410-

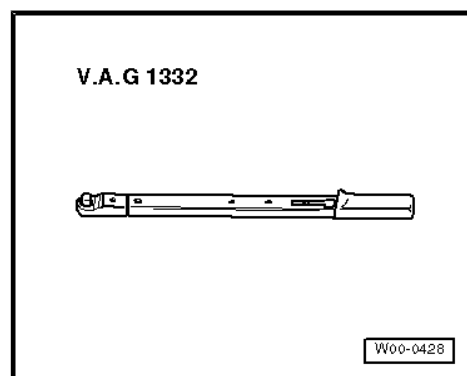




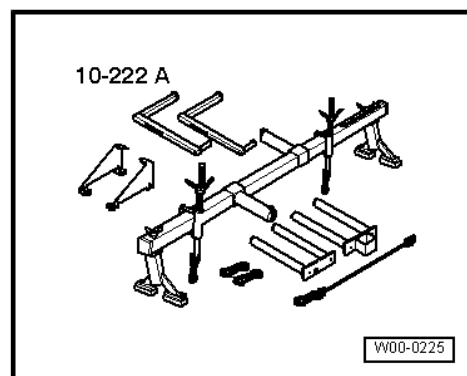
- ◆ Torque wrench -V.A.G 1331/-



- ◆ Torque wrench -V.A.G 1332-



- ◆ Support bracket -10-222A-



Not illustrated

- ◆ Lifting tackle -2024 A/02-
- ◆ Adapter -10-222A/03-
- ◆ Adapter -10-222A/18-
- ◆ Adapter -10-222A/19-



Caution

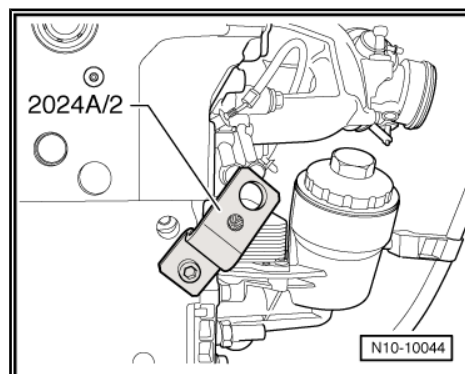
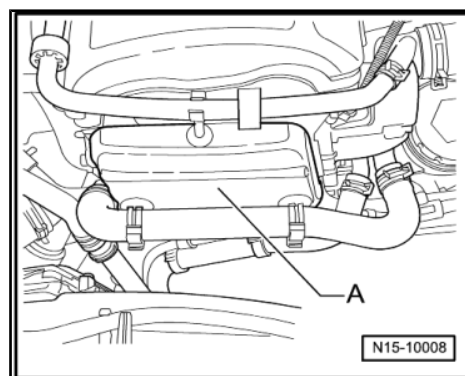
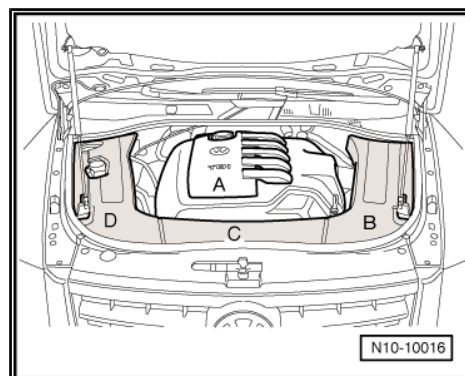
When a mechanical fault is found on the turbocharger, e.g. a destroyed compressor impeller, it is not only sufficient to renew the turbocharger. To avoid subsequent damage, the following work must be carried out:

- ◆ *Check air filter housing, air filter element and intake hoses for soiling.*
- ◆ *Check complete charged air routing and charge air cooler for foreign objects.*

If foreign objects are found in the charge air system, the charged air routing must be cleaned and the charge air cooler must be renewed, if necessary.

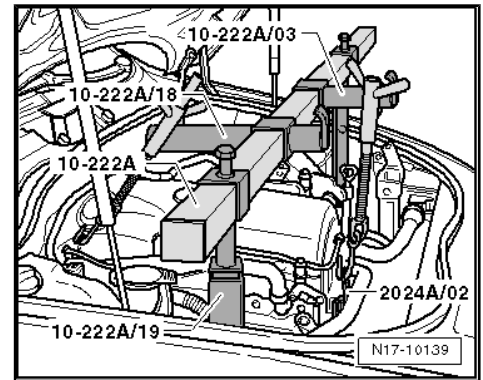
Removing

- Remove engine cover -A- and engine compartment covers -B-, -C- and -D-, if fitted.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Assembly overview - noise insulation .
- Remove air filter housing ⇒ [page 138](#) .
- Loosen charge air pipe and vacuum line from turbocharger.
- Remove exhaust gas recirculation cooler ⇒ [page 157](#) .
- Removing exhaust manifold ⇒ [page 148](#) .
- Remove front exhaust pipe together with diesel particulate filter ⇒ [page 147](#) .
- Remove noise insulation -A-.
- Fit lifting tackle -2024A/2- on cylinder block as shown.
- Support bonnet with suitable workshop equipment.
- Unclip lower bonnet dampers.

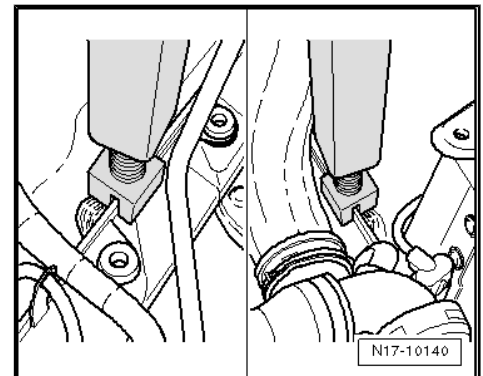




- Fit support bracket -10-222A- .



- Observe mounting points on longitudinal members.
- Remove right engine mounting and right engine bracket
⇒ [page 18](#) .



- Unscrew bolt -1- and nuts -2-.
- Remove turbocharger.

Installing

Installing the turbocharger is carried out in reverse order of removal.

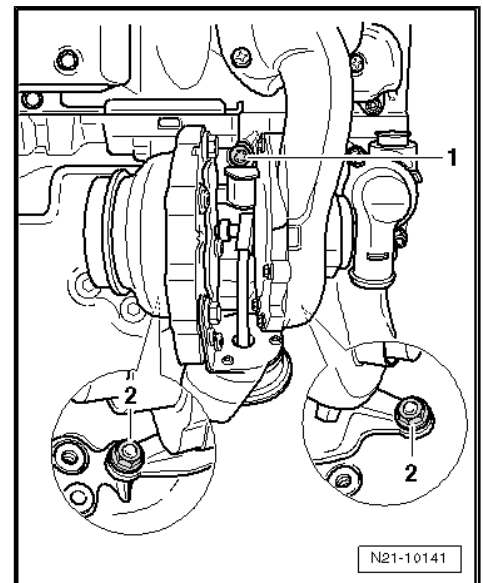
- Guide turbocharger onto studs on cylinder block.



Caution

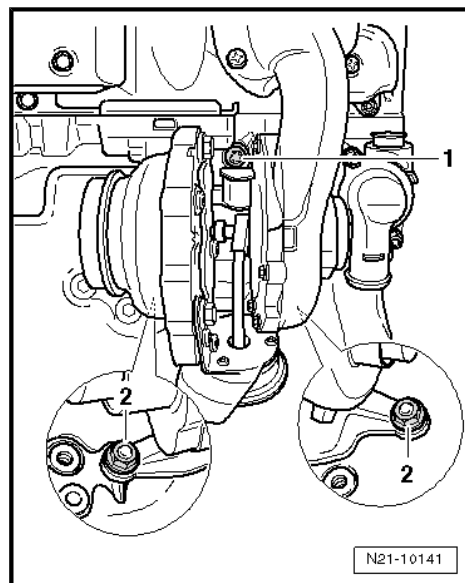
If the assembly sequence is not followed, the seal may be damaged and exhaust emissions may escape.

- Tighten bolt -1- ⇒ [Item 16 \(page 116\)](#) .





- Tighten nuts -2- ⇒ [Item 15 \(page 116\)](#) .
- Install exhaust manifold with sealing set ⇒ [page 148](#) .
- Install exhaust gas recirculation cooler ⇒ [page 157](#) .
- Remove front exhaust pipe together with diesel particulate filter ⇒ [page 147](#) .



1.6 Removing and installing parts of charge air cooling

Assembly of hose connections
⇒ [„1.8 Hose connections“, page 123](#)



1 - Air duct

2 - 8 Nm

3 - Shim

4 - Charge air cooler

- ☐ To remove bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Body - front; Removing and installing bumper cover. .

5 - Seal

- ☐ Renew if damaged.
- ☐ If renewed, observe fitting instructions
⇒ [page 123](#)

6 - 3 Nm

7 - Charge air pressure sender -G31- with intake air temperature sender -G42-

8 - Charge air pipe/connecting hose

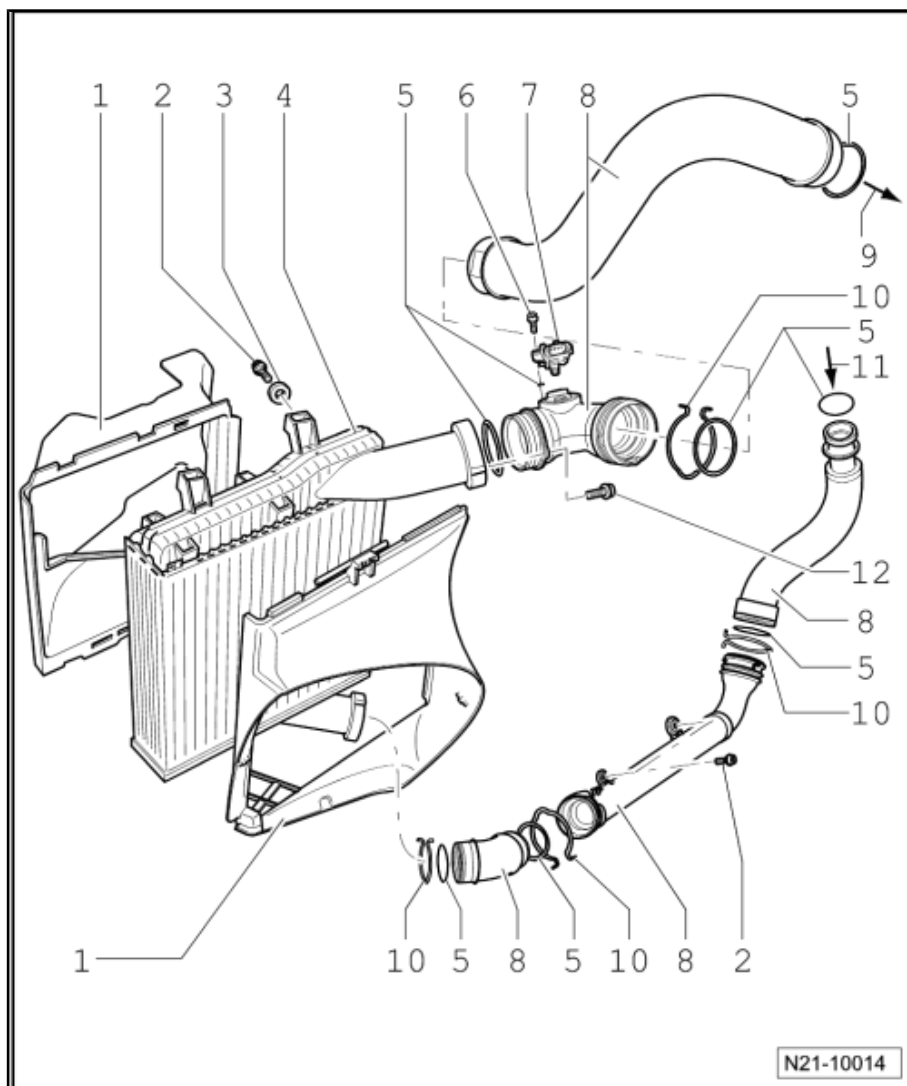
9 - To intake connecting pipe.

10 - Retaining clip

- ☐ Check for secure seating.

11 - From turbocharger

12 - 8 Nm



1.7 Checking charge air system for leaks

Special tools and workshop equipment required

- ◆ Charge air system tester -V.A.G 1687-
- ◆ Adapter -V.A.G 1687/4-
- ◆ Adapter -V.A.G 1687/10-



- Remove intake hose -1- from air filter.
- Insert adapter -V.A.G 1687/10- in intake hose -1- and secure with clip.
- Detach hose from valve for crankcase breather system.
- Seal hose using adapter -V.A.G 1687/4- and secure with clamp.

Prepare charge air system tester -V.A.G 1687- as follows:

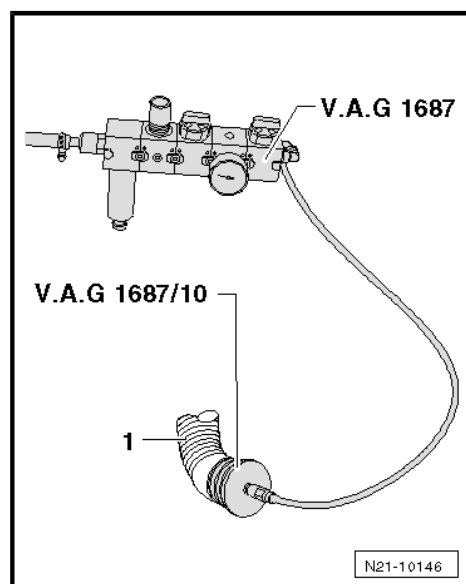
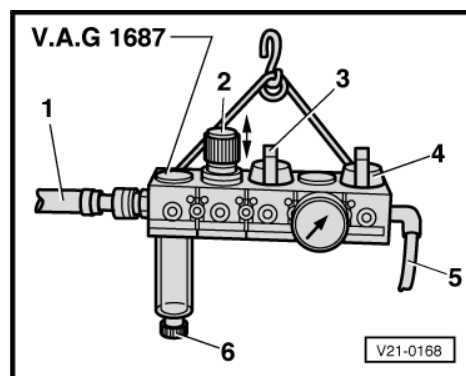
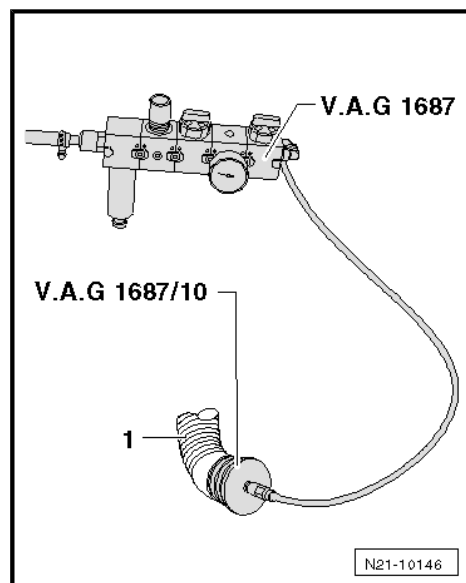
- Turn pressure regulating valve -2- anti-clockwise onto stop.
- Close valves -3- and -4-.



Note

To turn the pressure regulating valve -2- the knob must be pulled upwards.

- Connect charge air system tester -V.A.G 1687- to adapter -1687/10- as shown.





- Connect compressed air hose -1- (compressed air source) to charge air system tester -V.A.G 1687- .



Note

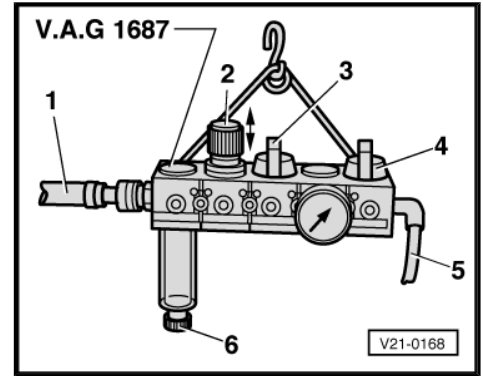
If there is water in the sight glass, drain at water drain screw -6-.

- Open valve -3-.
- Adjust pressure to 0.5 bar with pressure regulating valve -2-.



Caution

The pressure must not exceed 0.5 bar! If the pressure is too high this can cause damage to the engine.



- Open valve -4- and wait until the test circuit is filled. If necessary readjust pressure to 0.5 bar.
- Check charge air system via:
 - ◆ listening
 - ◆ feeling
 - ◆ with leak detector spray
- or with ultrasonic tester -V.A.G 1842- for leaks.



Note

- ◆ *Slight leaks on the intake side of turbocharger are permissible, as the intake hoses are not designed for high-pressure.*
- ◆ *A small amount of air escapes through the valves and enters the engine. Therefore a holding pressure test is not possible.*
- ◆ *How to use the ultrasonic tester -V.A.G 1842- ⇒ operating instructions*
- ◆ *If leaks occur, when doing any repair work observe notes for charge air system ⇒ [page 120](#) .*
- ◆ *Before removing the adapter, depressurise the test circuit by pulling coupling off adapter -1687/1- .*

1.8 Hose connections

⇒ „1.8.1 Fitting hose connections with plug-in connectors“, [page 123](#)

⇒ „1.8.2 Hose connections with spring band ring“, [page 124](#)

1.8.1 Fitting hose connections with plug-in connectors



Caution

The seal in the plug-in connector can be damaged if the securing clip is in the locked position when fitting the connector. This can cause leakage. Observe installation instructions.

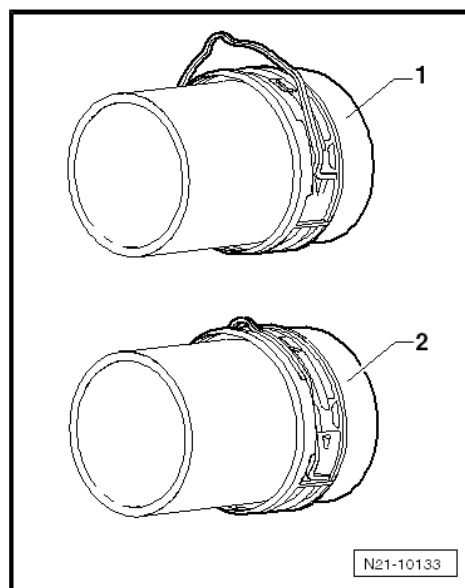
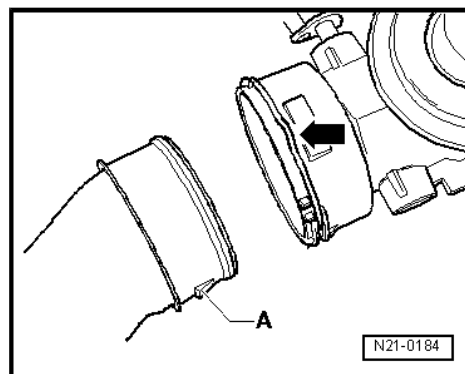


Removing

- Release plug-in connector by pulling out retaining clip -arrow-. Separate hose/pipe without tools.

Installing

- If renewed, place oil seal in groove of charge air hose. Ensure the seal is correctly seated in the groove.
- Lubricate sealing surface and seal with oil.
- Bring retaining clip to release position -1-.
- Push charge air hose into coupling to stop.
- Bring securing clip to locking position -2- and then push charge air hose again.
- Check if connector coupling seats correctly and is properly engaged by pulling hose.

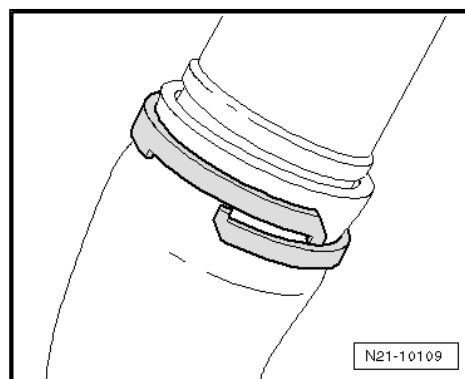


1.8.2 Hose connections with spring band ring



Note

There is a danger of a „hose detaching“ whilst driving after removing and reinstalling charge air lines with spring-type clips. For this reason, spring band rings are used; these must only be opened if a defect requires the charge air line to be opened. In cases of repair, the charge air pipe must be removed if necessary, the spring band ring must be destroyed using a suitable tool (e.g. angle grinder) and must be renewed by a replacement part according to ⇒ Electronic parts catalogue (ETKA) .





1.9 Vacuum hose schematic diagram

⇒ „1.9.1 Vacuum hose schematic diagram for engine codes BAC and BLK“, page 125

⇒ „1.9.2 Vacuum hose schematic diagram for engine codes BPD and BPE“, page 126

1.9.1 Vacuum hose schematic diagram for engine codes BAC and BLK

1 - Charge pressure control solenoid valve -N75-

2 - Exhaust gas recirculation cooler changeover valve - N345-

- ☐ For exhaust gas recirculation cooler.
- ☐ Only vehicles with an automatic gearbox.

3 - Brake servo line

4 - Exhaust gas recirculation valve

- ☐ Part of intake connecting pipe
- ☐ Can only be renewed together with intake connecting pipe

5 - Exhaust gas recirculation valve -N18- (electro-pneumatic)

6 - Variable intake manifold flap changeover valve -N239-

7 - Vacuum reservoir

8 - Non-return valve

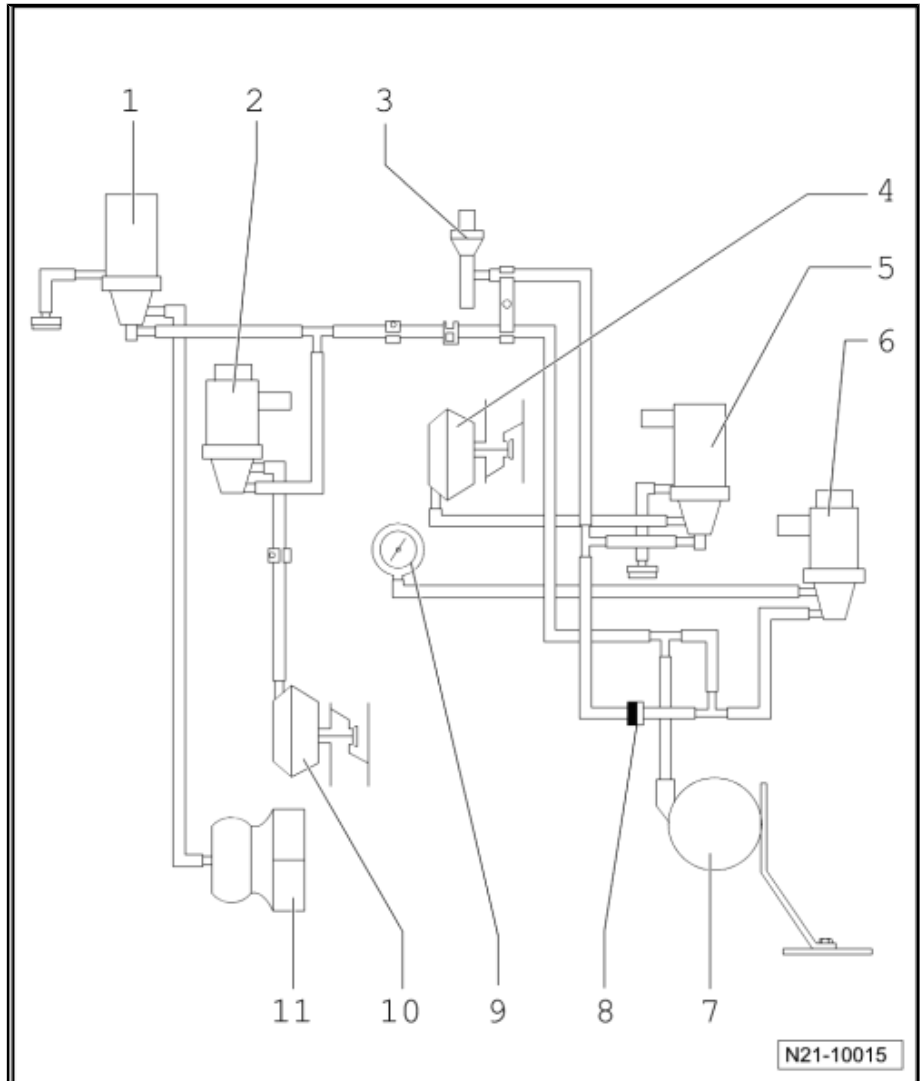
- ☐ Note installation position.

9 - Intake manifold flap

10 - Change-over flap

- ☐ For exhaust gas recirculation cooler.
- ☐ Only vehicles with an automatic gearbox.

11 - Turbocharger





1.9.2 Vacuum hose schematic diagram for engine codes BPD and BPE

1 - Brake servo line

2 - Non-return valve

- ☐ Note installation position.

3 - Charge pressure control solenoid valve -N75-

4 - Exhaust gas recirculation cooler changeover valve - N345-

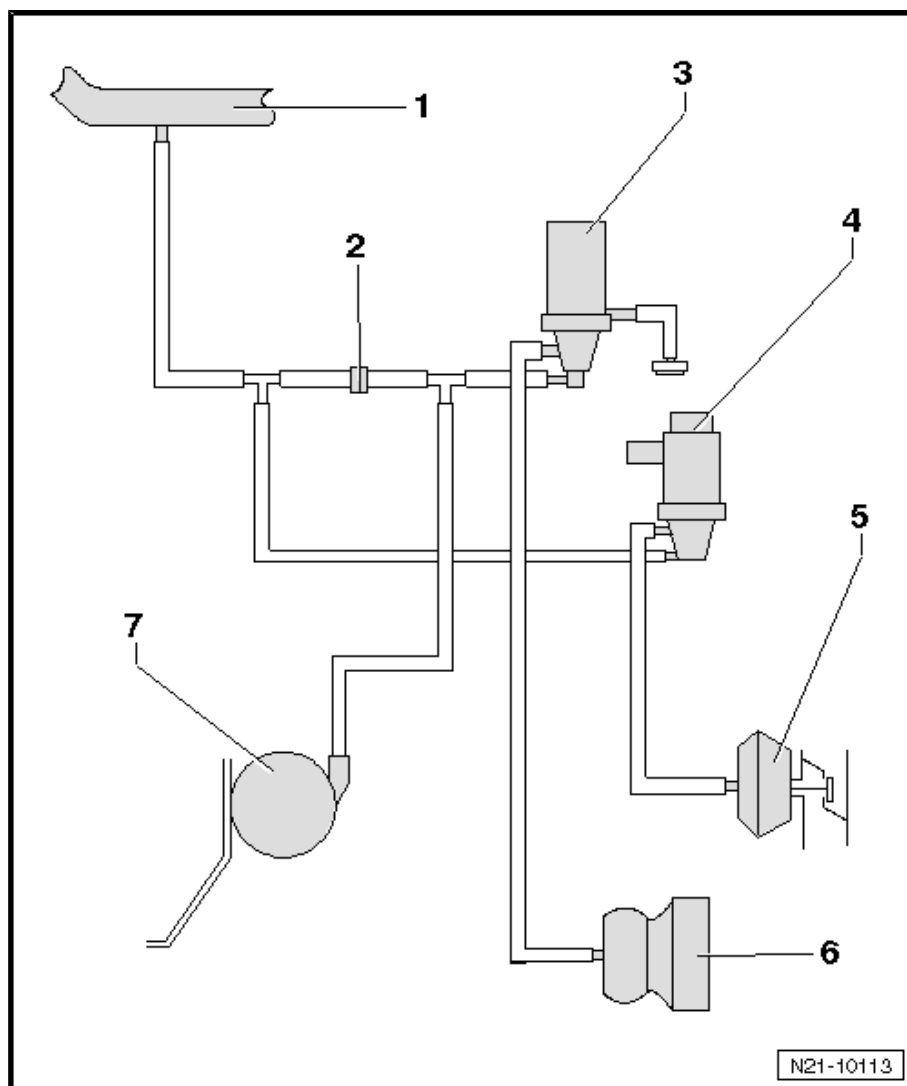
- ☐ For exhaust gas recirculation cooler.

5 - Change-over flap

- ☐ For exhaust gas recirculation cooler.

6 - Turbocharger

7 - Vacuum reservoir





23 – Mixture preparation - injection

1 Repairing diesel direct injection system

The diesel direct injection system control unit is equipped with an event memory. Read event memory before and after making repairs or adjustments ⇒ Vehicle diagnosis tester .

⇒ „1.1 Safety precautions“, page 127

⇒ „1.2 Rules for cleanliness“, page 128

⇒ „1.3 Removing and installing unit injector“, page 128

⇒ „1.4 Assembly overview - unit injector“, page 132

⇒ „1.5 Removing and installing O-rings for unit injector“, page 133

⇒ „1.6 Assembly overview - intake manifold and fuel rail“, page 135

⇒ „1.7 Repairing intake manifold flap“, page 136

⇒ „1.8 Dismantling and assembling air filter“, page 138

1.1 Safety precautions



WARNING

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- ◆ *All the various lines, e.g. for activated charcoal filter system, electrical wiring as well as*
- ◆ *Fuel lines*
- ◆ *Hydraulic lines*
- ◆ *Coolant and refrigerant lines*
- ◆ *Lines for brake fluid*
- ◆ *and vacuum lines*
- ◆ *must be routed in their original positions.*
- ◆ *Ensure that there is sufficient clearance to all moving or hot components.*

Note the following if testers and measuring instruments have to be used during a road test:

- ◆ Test and measuring instruments must always be secured to rear seat and operated by a second person from this location.

If test and measuring instruments are operated from front passenger seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is triggered.



WARNING

Secure fault reader to rear seat and operate from this position.



To prevent injuries to persons and/or destruction of the injection and glow plug system, the following must be noted:

- ◆ The ignition must be switched off before connecting or disconnecting glow plug system and injection system lines or tester cables.
- ◆ If the engine is to be turned at starter speed, without starting, e.g. when checking compressions, disconnect unit injector connector on cylinder head.
- ◆ Before disconnecting battery, obtain radio code for radios with anti-theft coding.
- ◆ Disconnecting and connecting the battery must only be done with the ignition switched off, as otherwise the control unit for diesel direct injection system could become damaged.

1.2 Rules for cleanliness

When working on the fuel supply and injection system, pay careful attention to the following „6 rules“ for cleanliness:

- ◆ Thoroughly clean all unions and surrounding areas before disconnecting.
- ◆ Place removed parts on a clean surface and cover. Use only lint-free cloths.
- ◆ Carefully cover opened components or seal if repairs cannot be carried out immediately.
- ◆ Install clean components only. Do not remove replacement parts from packing until immediately before installing. Do not use parts that have not been stored in their packing (e.g. in tool boxes etc.).
- ◆ When system is open: do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.
- ◆ Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

1.3 Removing and installing unit injector

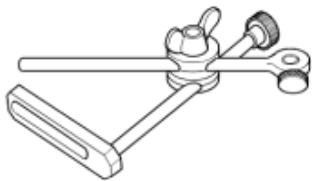
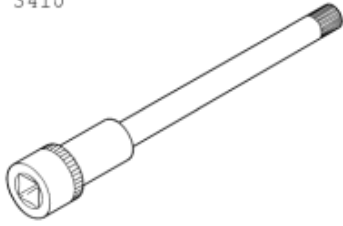
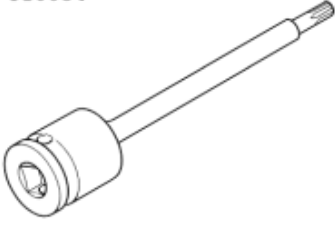
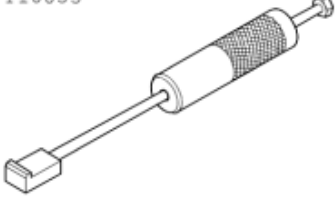
⇒ „1.3.1 Removing“, page 130

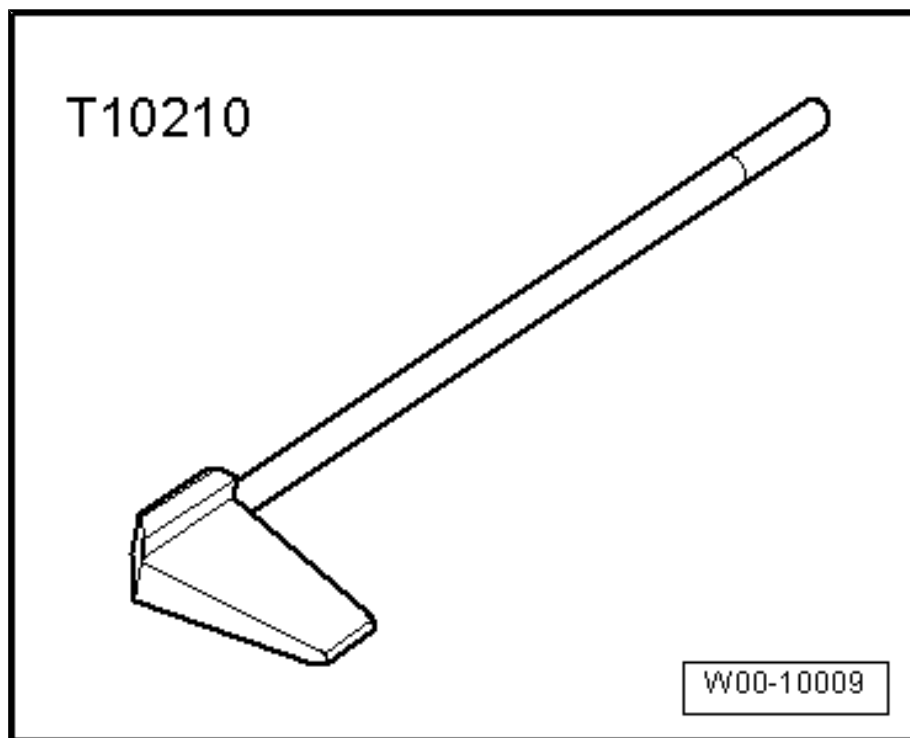
⇒ „1.3.2 Installing“, page 131



Special tools and workshop equipment required

- ◆ Universal dial gauge bracket -VW 387-
- ◆ Allen key, long reach -3410-
- ◆ Allen key, long reach - T10054-
- ◆ Puller -T10055-
- ◆ Torque wrench - V.A.G 1331- (5 ... 50 Nm)

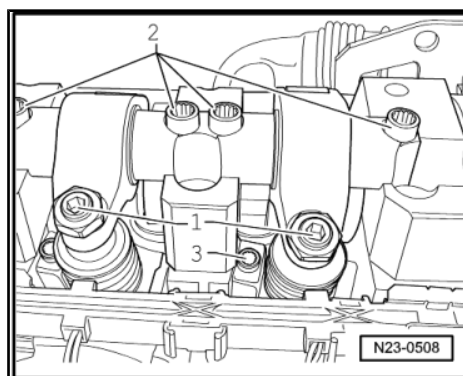
VW 387 	3410 
T10054 	T10055 
V.A.G 1331 	W23-0020



◆ Gauge -T10-210-

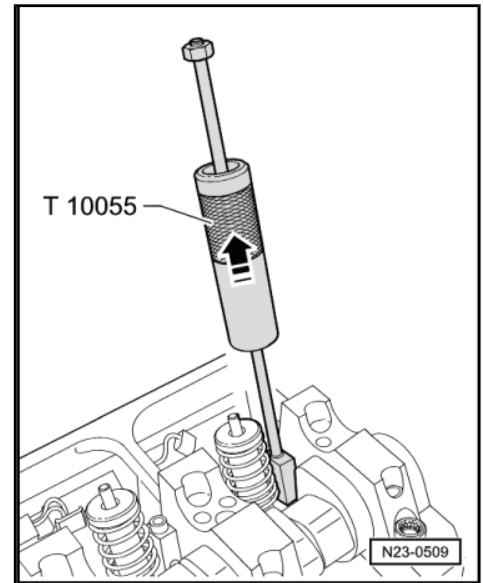
1.3.1 Removing

- Remove cylinder head cover.
- Turn crankshaft until the cam pair point evenly upwards for the unit injector which is to be removed.
- Loosen lock nut of adjuster screws -1- and screw adjuster screws out until the relevant rocker arm lies against the plunger spring of the unit injector.
- Remove rocker arm securing bolts -2- (from outwards to inwards) with socket XZN 10 -3410- and remove rocker arm shaft.
- Remove tensioning block securing bolt -3- with special wrench, long reach -T10054- and remove the block.
- Lever connector off unit injector using a screwdriver. Support opposite side of connector with light finger pressure to prevent canting.





- Seat the puller into the slot on the side of the unit injector instead of the tensioning block.
- Pull unit injector out of cylinder head seat by gently tapping upwards.



1.3.2 Installing

Note

- ◆ *If a new unit injector is installed, the appropriate adjustment screw in the rocker arm must also be renewed.*
- ◆ *Each time work is performed which requires adjustment of the unit injector, the adjustment screw in the rocker arm and also the unit injector ball stud must be renewed.*
- ◆ *New unit injectors are supplied with O-rings and heat shield seal.*
- Heat insulating seal and O-rings must be renewed if old unit injector is reused ➔ [page 133](#) .
- Check that the 3 O-rings and the heat shield seal along with securing clip are seated correctly before installing unit injector.

Note

The seals must not be twisted.

- Oil the seals and fit the unit injector into the seat in cylinder head with great care.
- Push the unit injector evenly into the cylinder head onto its limit stop.
- Insert tensioning block in slot on side of unit injector.

Note

If the unit injector is not at right angles to the tensioning block the securing bolt may loosen and this can damage the unit injector or the cylinder head.

- Therefore align the unit injector as follows.
- Screw new securing bolt into clamping block, but do not tighten (it must still be possible to turn the unit injector slightly).



- Position gauge -T10210- between mounting bracket and unit injector as shown.
- Turn unit injector by hand against gauge.
- If necessary, adjust the unit injector and tighten the securing bolt as follows:

12 Nm and + 270° (3/4 turn) further.

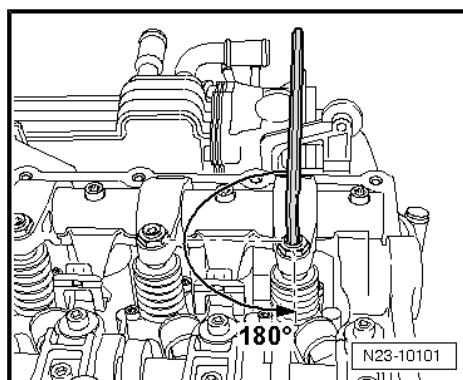
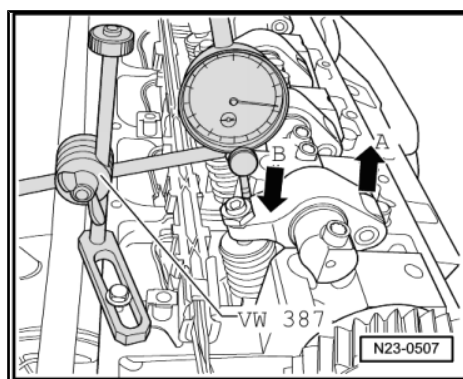
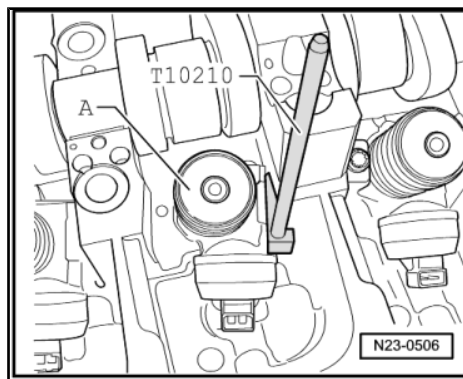
(Turning further can be carried out in several stages)

- Fit rocker arm shaft and tighten new securing bolts as follows.
- Tighten inner and then both outer bolts hand-tight. Then using same sequence, tighten to 20 Nm and turn 90° (1/4 turn) further.

- Fit dial gauge onto adjustment screw of unit injector as shown.
- Turn crankshaft in direction of engine rotation until roller of rocker arm is located at tip of drive cam.

Roller side -arrow A- is at highest point. Adjuster screw of unit injector -arrow B- is at lowest pump.

- Remove dial gauge.
- Now turn adjuster screw into rocker arm against spring pressure of unit injector until firm resistance is felt (unit injector positioned at stop).
- Turn adjustment screw 180° back off stop.
- Hold adjuster screw in this position and tighten lock nut to 30 Nm.
- Reconnect unit injector connector and install cylinder head cover.



1.4 Assembly overview - unit injector

- ◆ Observe rules for cleanliness ➔ [page 128](#) .
- ◆ Always renew seals and O-rings



1 - 20 Nm + 90° further

- ☐ Renew.

2 - Lock nut

3 - Adjuster screw

- ☐ Renew each time it is separated from ball pin

4 - Rocker arm shaft

- ☐ With rocker arms
- ☐ Removing and installing
⇒ [page 128](#), removing and installing unit injector
- ☐ Check ball pin for signs of wear, replace if necessary
- ☐ Removing and installing
⇒ [page 128](#)

5 - Tensioning block

6 - 12 Nm + 270° further

- ☐ Renew.

7 - Unit injector

- ☐ Removing and installing
⇒ [page 128](#)

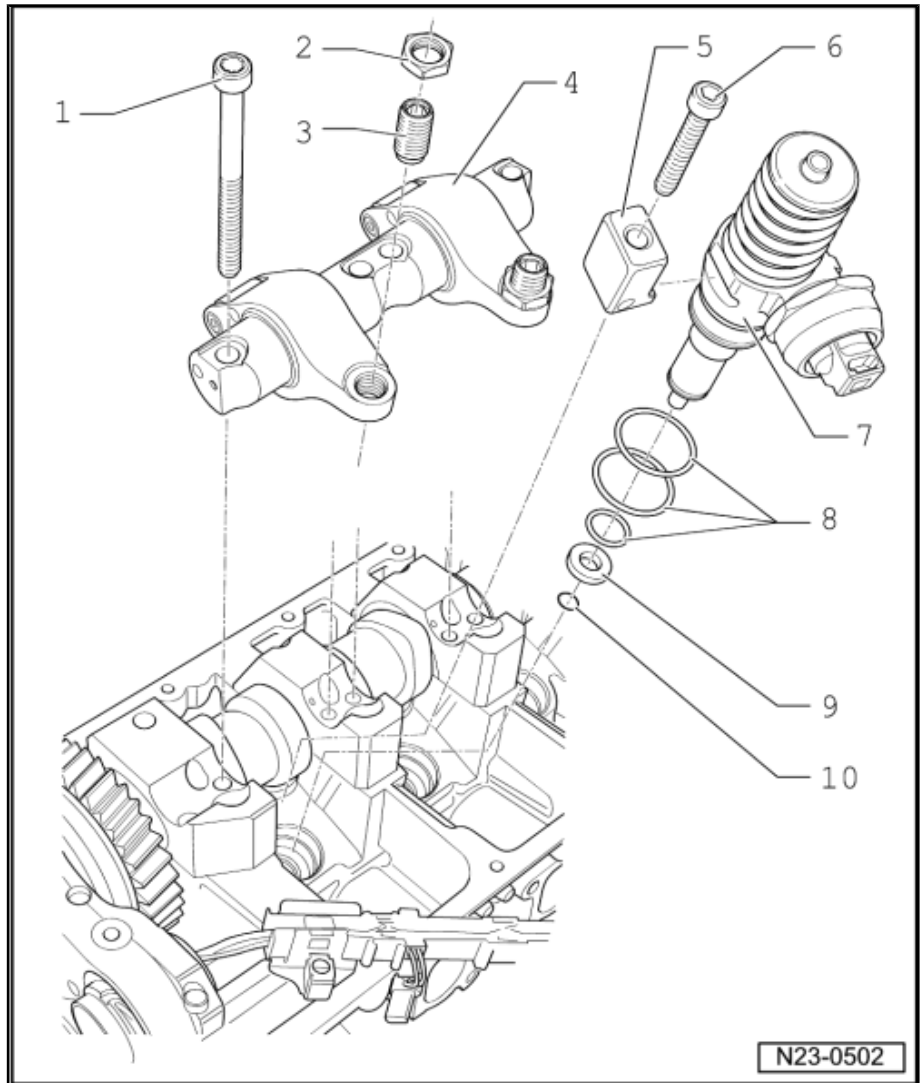
8 - O-ring

- ☐ Renew. ⇒ [page 133](#).

9 - Heat shield seal

- ☐ Renew.

10 - Circlip

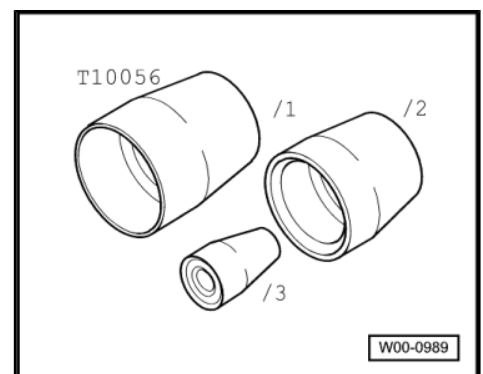


N23-0502

1.5 Removing and installing O-rings for unit injector

Special tools and workshop equipment required

- ◆ Assembly sleeves -T10056-



W00-0989

Removing

- Lever old O-rings very carefully out of unit injector.
- Pay particular attention to ensure that seat of O-ring is not damaged by burrs.



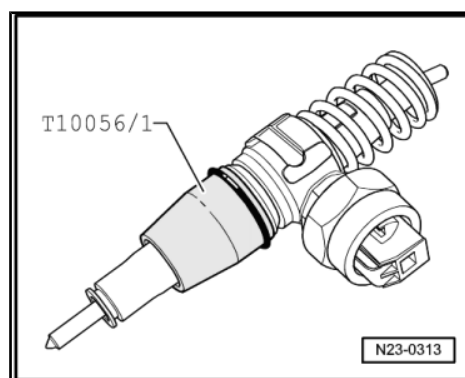
Installing



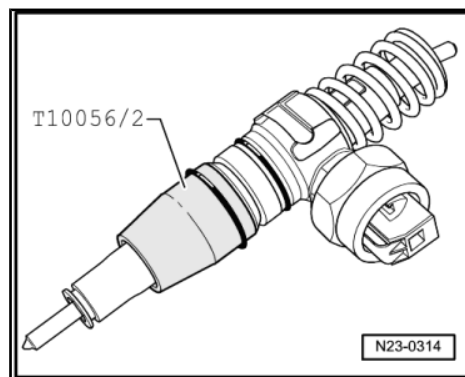
Note

- ◆ *Always use the assembly sleeves to fit the O-rings. There is a danger of damaging the O-rings if the sleeves are not used.*
- ◆ *Gradual introduction of O-rings without different coloured markings. Note the correct allocation of O-rings to grooves: the thickness of the rings reduces towards injector nozzle.*
- ◆ *Prevent O-rings from rolling when sliding them on. The O-rings must not be twisted in their seats in unit injector.*

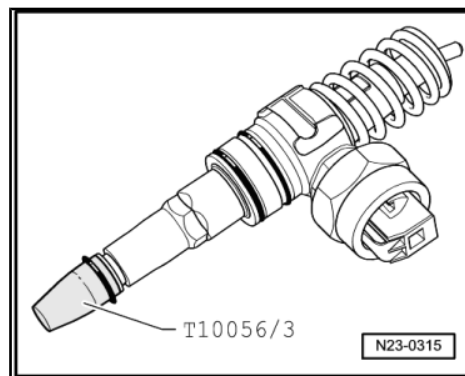
- Pull heat shield seal off together with securing clip.
- Clean seating surfaces for O-rings on unit injector very carefully.
- Place assembly sleeve -T10056/1- onto stop on unit injector.
- Push the upper, thicker O-ring carefully onto assembly sleeve and into seat on unit injector.
- Remove assembly sleeve.



- Place assembly sleeve -T10056/2- onto stop on unit injector.
- Slide the middle, thinner O-ring carefully onto assembly sleeve and into seat on unit injector.
- Remove assembly sleeve.



- Place assembly sleeve -T10056/3- onto stop on unit injector.
- Push the lower O-ring carefully onto the assembly sleeve and into the seat of the unit injector.
- Remove assembly sleeve.
- Fit new heat shield seal together with securing clip.





1.6 Assembly overview - intake manifold and fuel rail

1 - Cylinder head

- ☐ Removing and installing
⇒ [page 42](#)

2 - Intake manifold support

3 - 10 Nm

4 - Intake manifold

5 - 20 Nm

6 - Fuel rail

7 - 8 Nm + 90° further

- ☐ Renew.

8 - Connection

- ☐ Long.
- ☐ For supply flow

9 - Connection

- ☐ Short.
- ☐ For return flow

10 - Seal

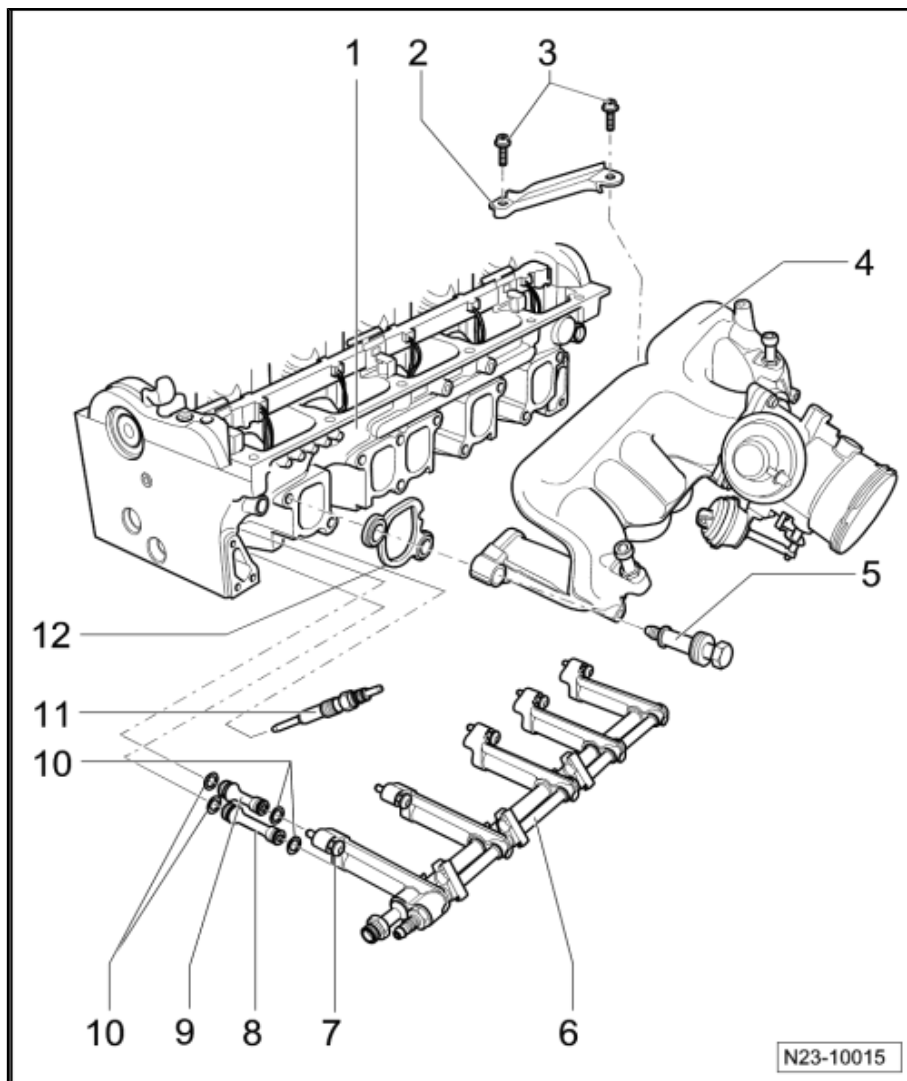
- ☐ Renew.

11 - Glow plug

- ☐ 15 Nm
- ☐ Checking ⇒ [page 160](#) .

12 - Gasket

- ☐ Renew.





1.7 Repairing intake manifold flap

⇒ „1.7.1 Repairing intake manifold flap for engine codes BAC and BLK“, page 136 .

⇒ „1.7.2 Repairing intake manifold flap for engine codes BPD and BPE“, page 137 .

1.7.1 Repairing intake manifold flap for engine codes BAC and BLK

The intake manifold flap is closed for approx. 3 seconds when stopping engine and then opens again. This reduces the stop jolt.

1 - Intake manifold

2 - O-ring

☐ Renew.

3 - Gasket

☐ Renew.

4 - Connecting pipe

☐ For exhaust gas recirculation.

5 - 20 Nm

6 - 10 Nm

7 - From charge air cooler

8 - Intake connecting pipe

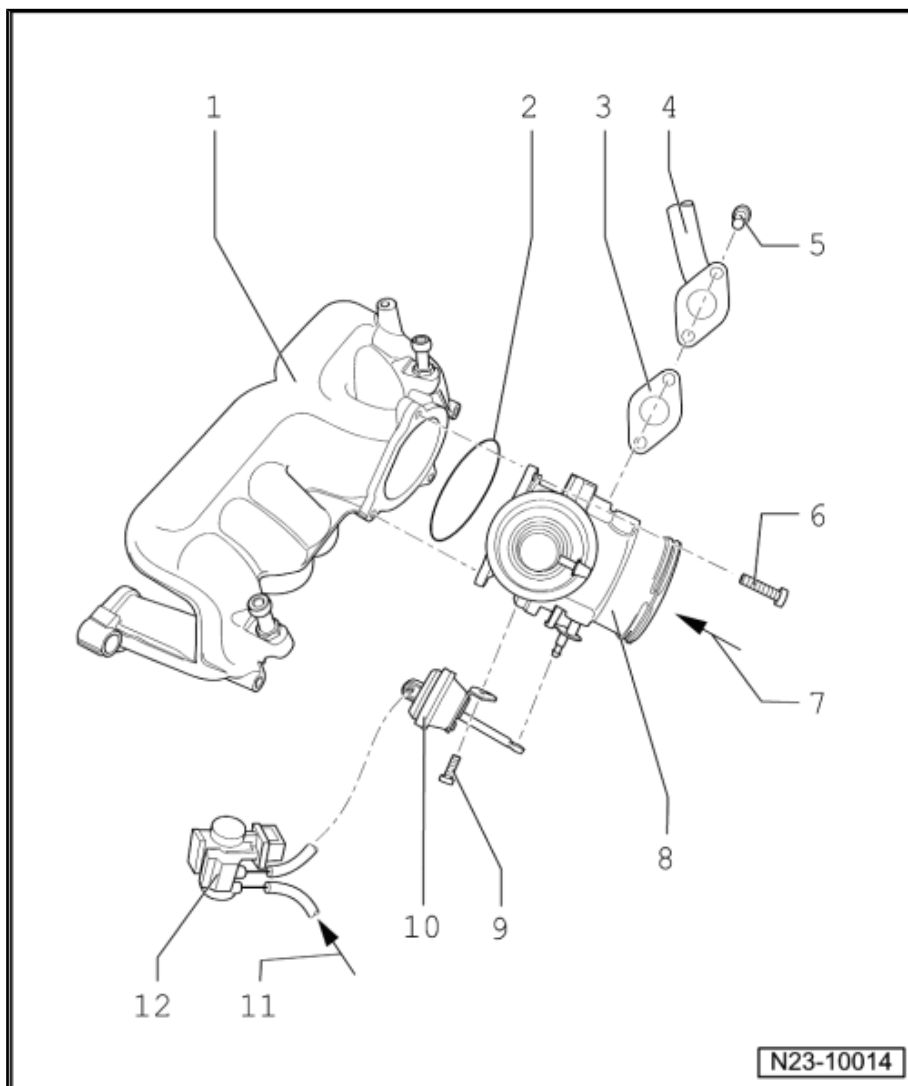
☐ With mechanical exhaust gas recirculation valve and intake manifold flap

9 - 10 Nm

10 - Vacuum actuator

11 - Vacuum supply

12 - Variable intake manifold flap changeover valve





1.7.2 Repairing intake manifold flap for engine codes BPD and BPE

1 - Intake manifold

2 - Seal

☐ Renew.

3 - Gasket

☐ Renew.

4 - Connecting pipe

☐ For exhaust gas recirculation cooler.

☐ Assembly overview - exhaust gas recirculation cooler ⇒ [page 157](#)

5 - 22 Nm

6 - 10 Nm

7 - Intake manifold flap motor - V157-

☐ The intake manifold flap is closed for approx. 3 seconds when stopping engine and then opens again. This reduces the stop jolt.

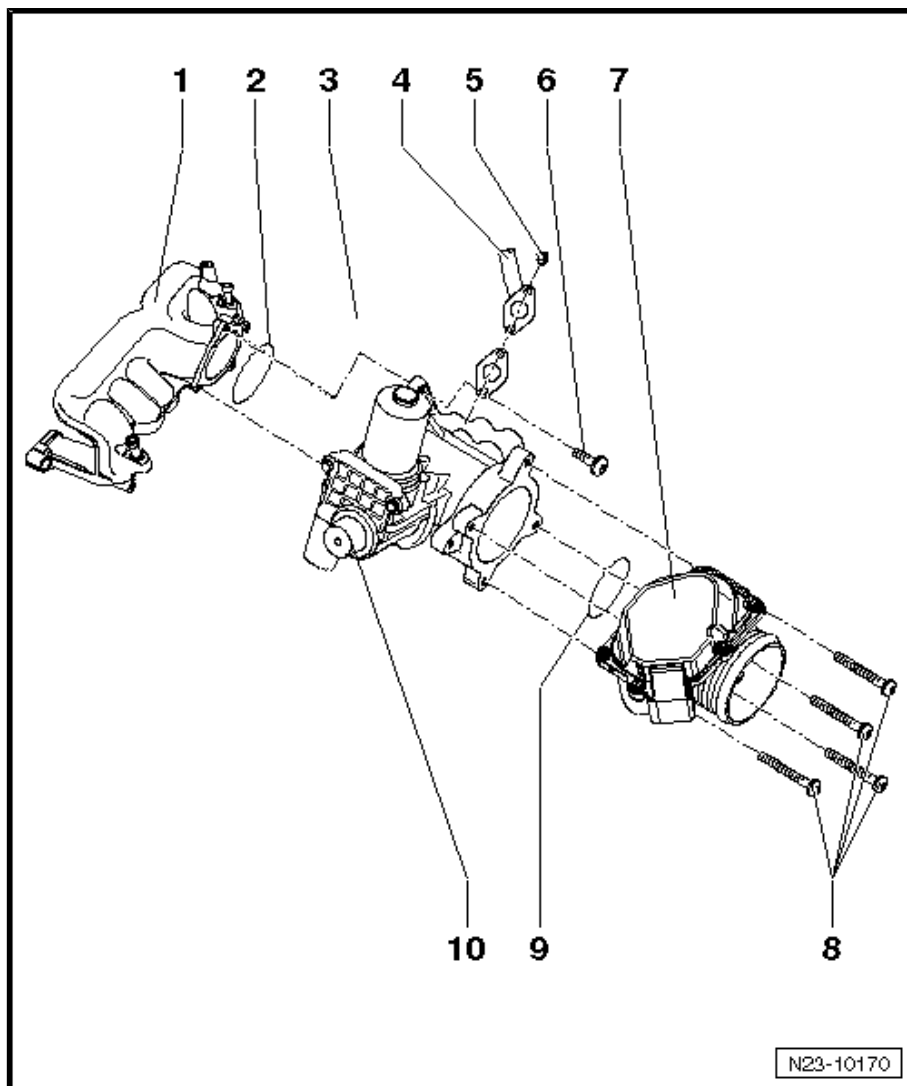
8 - 10 Nm

9 - Seal

☐ Renew.

10 - Exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer - G212-

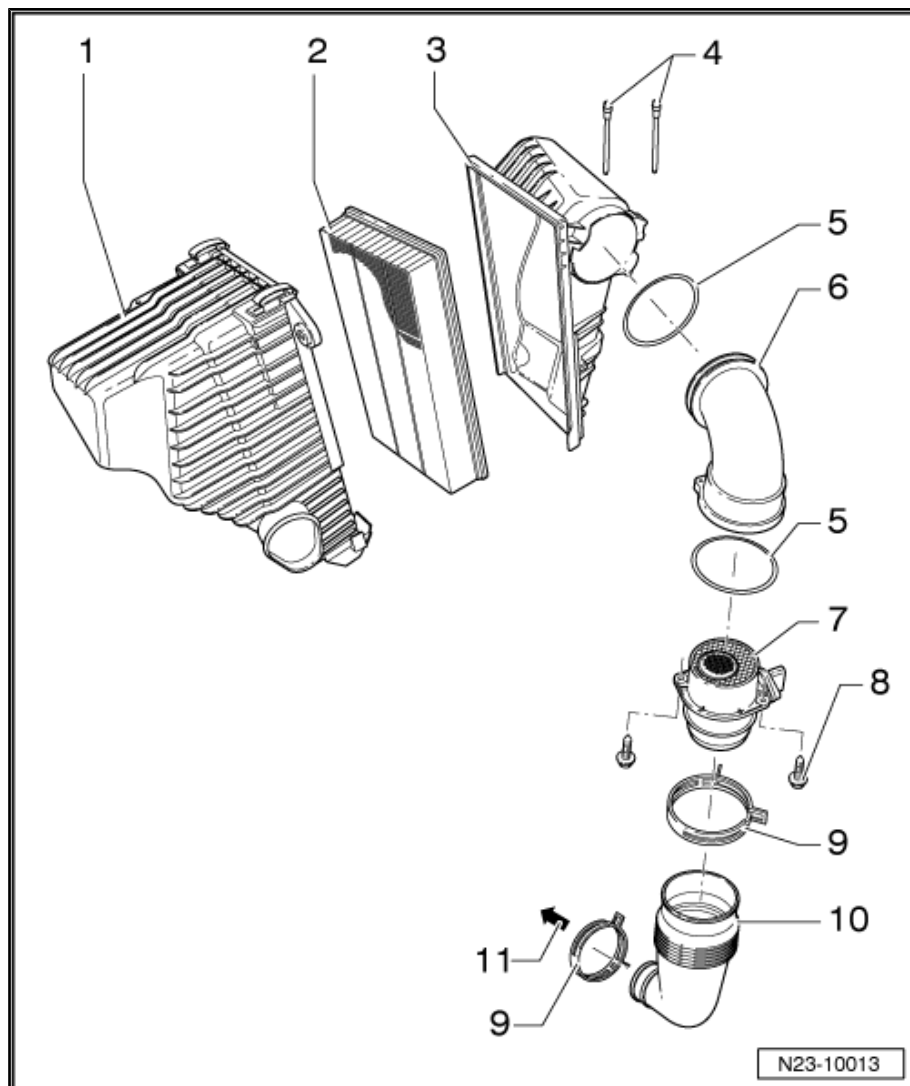
☐ Assembly overview - exhaust gas recirculation ⇒ [page 157](#)





1.8 Dismantling and assembling air filter

- 1 - Air filter lower part
- 2 - Filter element
- 3 - Air filter upper part
- 4 - Securing pins
 - ❑ Removing and installing
⇒ [page 138](#)
- 5 - O-ring
 - ❑ Renew if damaged.
- 6 - Intake manifold
- 7 - Air mass meter -G70-
- 8 - 6 Nm
- 9 - Clip
 - ❑ Remove and install using spring-type clip pliers -VAS 5024A- .
- 10 - Adapter
- 11 - To turbocharger.



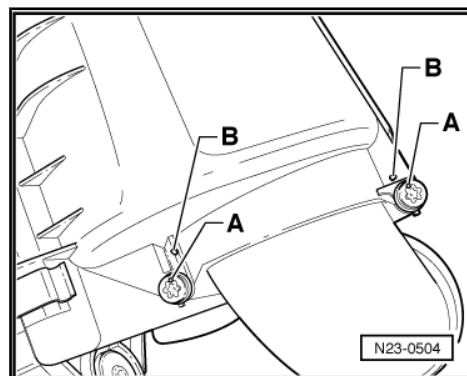
Removing and installing securing pins

Removing

- Turn securing pins using appropriate bit until markings -A- on pins and -B- on housing align.

Installing

- Press pins into bores to stop, rotate by 180°.





2 Engine control unit

⇒ „2.1 Reading and deleting engine control unit event memory“, page 139 .

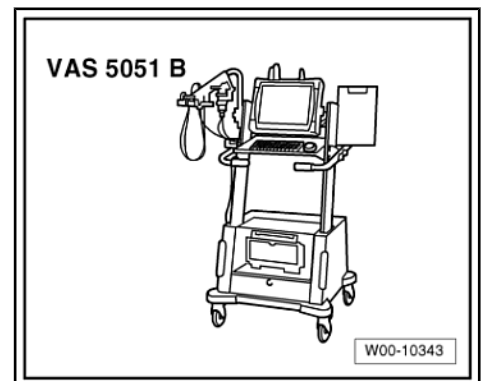
⇒ „2.2 Removing and installing engine control unit J623 “, page 140 .

⇒ „2.3 Removing and installing anti-theft engine control unit J623 “, page 140 .

2.1 Reading and deleting engine control unit event memory

Special tools and workshop equipment required

- ◆ Vehicle diagnosis, testing and information system -VAS 5051B-



Procedure

- Connect Vehicle diagnosis, testing and information system - VAS 5051B- as follows:
- Push diagnostic cable connector onto diagnostic connector.
- Start engine and run at idling speed.

Only when engine does not start:

- Switch on ignition.

Selecting operating mode:

- Press button on display for „Vehicle self-diagnosis“.

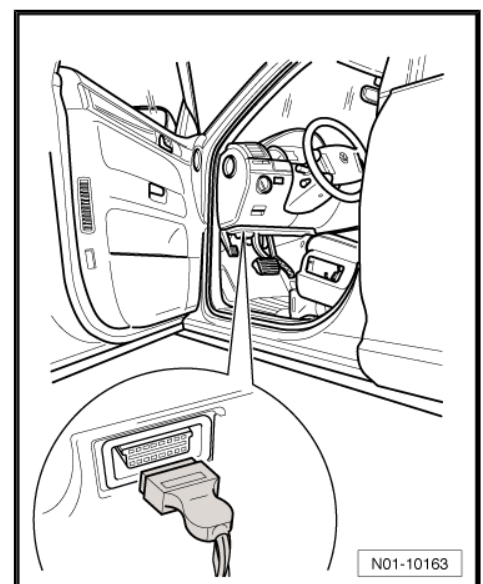
Selecting vehicle system:

- Press button „01 - Engine electronics“ on display to read control unit.

The display indicates the control unit identification and the coding of the engine control unit.

Select diagnostic function:

- Press button „02 - Read event memory“ on display.
- If no fault is stored in engine control unit „0 faults detected“ is displayed.
- If faults are stored in the engine control unit, these are shown one below the other on the display.
- Press button .
- Press button „05 - event memory“ on display.
- Press function „06-End output“.





2.2 Removing and installing engine control unit -J623-



Note

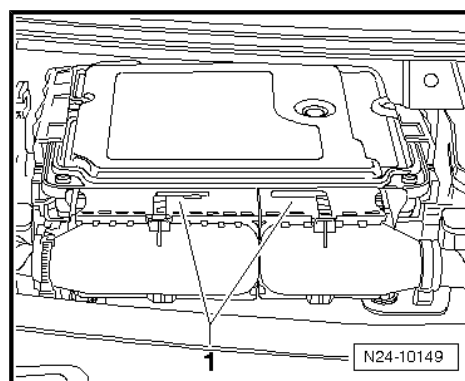
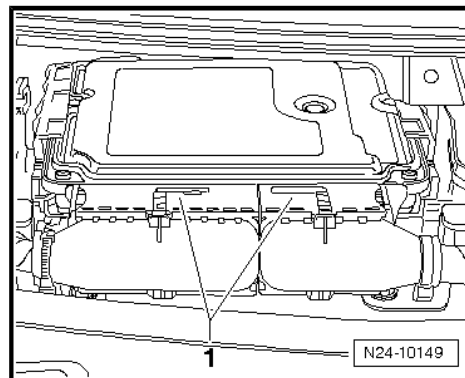
If the engine control unit is to be renewed, connect Vehicle diagnosis, testing and information system -VAS 5051B- and perform „Renewing engine control unit“ in guided functions.

Removing

- Switch off ignition.
- Remove wiper arms, ⇒ Electrical system; Rep. gr. 92 ; Wind-screen wiper system; Removing and installing wiper arms.
- Remove plenum chamber cover ⇒ General body repairs, exterior; Rep. gr. 64 ; Removing and installing plenum chamber cover.
- Slide connector locking devices -1- on engine control unit outwards and pull off both connectors.
- Press securing clips aside and remove engine control unit.

Installing

- Insert engine control unit into retaining frame in plenum chamber.
- Fit connectors to engine control unit and slide locking devices -1- inwards.
- Install plenum chamber cover ⇒ General body repairs, exterior; Rep. gr. 64 ; Removing and installing plenum chamber cover.
- Install wiper arms ⇒ Electrical system; Rep. gr. 92 ; Wind-screen wiper system; Removing and installing wiper arms .



2.3 Removing and installing anti-theft engine control unit -J623-



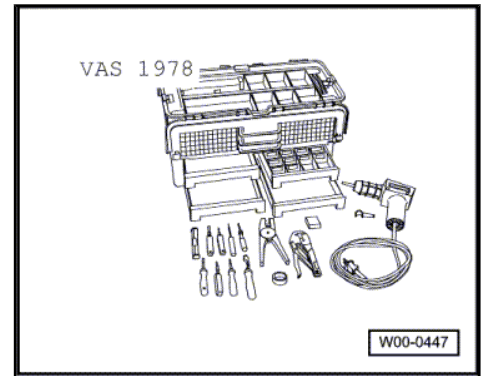
Note

If the engine control unit is to be renewed, connect Vehicle diagnosis, testing and information system -VAS 5051B- and perform „Renewing engine control unit“ in guided functions.

Special tools and workshop equipment required



- ◆ Hot air blower from wiring harness repair set -VAS 1978-



- ◆ Nozzle attachment from wiring harness repair set -VAS 1978-

Removing

- Switch off ignition.
- Remove wiper arms, ⇒ Electrical system; Rep. gr. 92 ; Wind-screen wiper system; Removing and installing wiper arms.
- Remove plenum chamber cover ⇒ General body repairs, exterior; Rep. gr. 64 ; Removing and installing plenum chamber cover.



Note

The shear-head bolt threads are coated with locking compound. Heating the shear-head bolt with a hot air blower releases the locking effect of the locking compound.



Caution

Cover lines, connections and control units in the vicinity of the engine control unit to prevent damage through heat.

Perform settings on hot air blower -4- as shown:

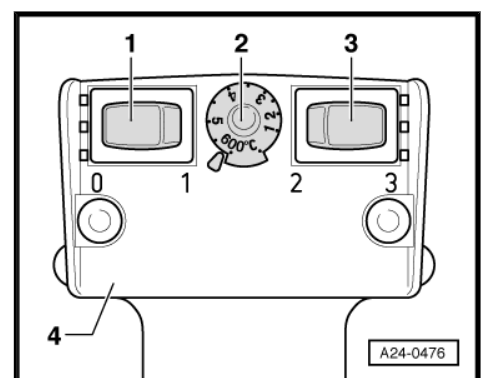
- Turn temperature setting potentiometer -2- to maximum heat output (600°C).
- Set two-stage switch for volume of air -3- to position 3.



WARNING

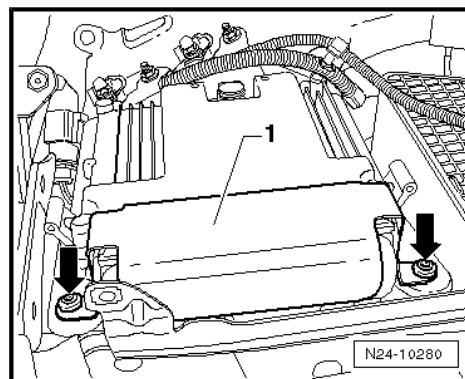
When shear-head bolts are heated up, parts of the protective housing will be subjected to a large amount of heat. Wear protective gloves to avoid possible injury.

- Place nozzle of hot air blower close to shear-head bolt.

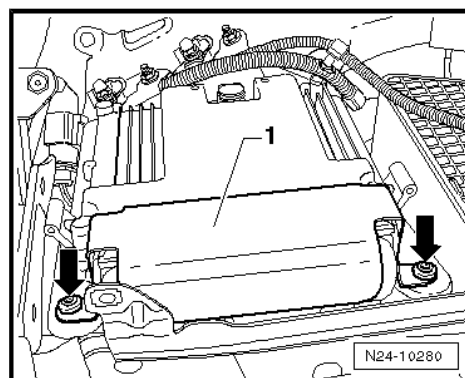




- Switch on hot air blower and warm bolt heads -arrows- for approximately 20 to 25 seconds.
 - Unscrew shear-head bolt using mole grips/pliers on bolt head.
- The procedure for the second shear-head bolt is identical.



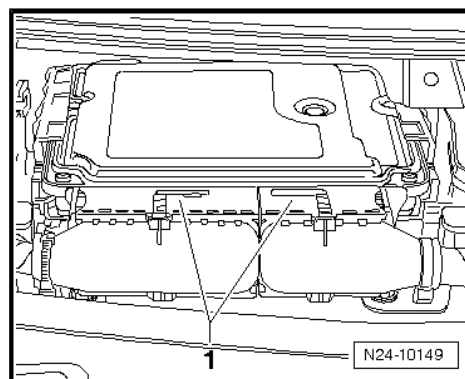
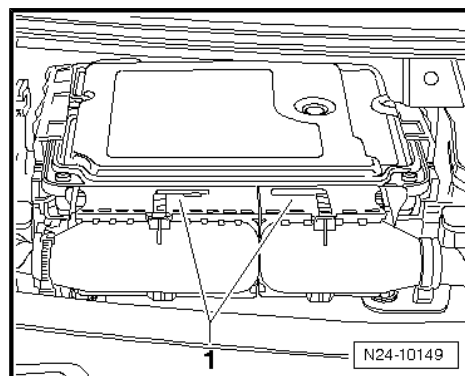
- Remove cover -1- from control unit.



- Slide connector locking devices -1- on engine control unit outwards and pull off both connectors.
- Remove engine control unit.

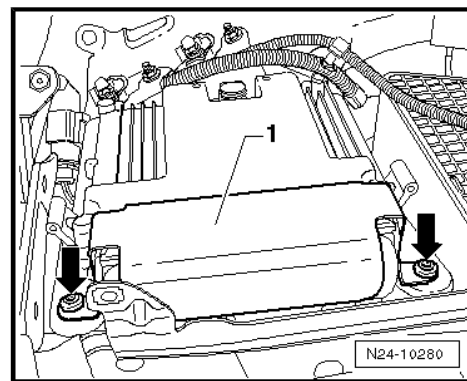
Installing

- Insert engine control unit into retaining frame in plenum chamber.
- Fit connectors to engine control unit and slide locking devices -1- inwards.





- Place cover -1- over engine control unit and fit new shear-head bolts -arrows- by hand.
- Then tighten new shear-head bolts evenly until heads shear off.
- Install plenum chamber cover ⇒ General body repairs, exterior; Rep. gr. 64 ; Removing and installing plenum chamber cover.
- Install wiper arms ⇒ Electrical system; Rep. gr. 92 ; Wind-screen wiper system; Removing and installing wiper arms.





26 – Exhaust system

1 Exhaust system



Note

- ◆ *After working on the exhaust system, ensure that the system is not under stress and that there is sufficient clearance to the bodywork. If necessary, loosen double and single clamps and align silencer and exhaust pipe so that sufficient clearance is maintained to the bodywork and the support rings are evenly loaded.*
- ◆ *Renew self-locking nuts.*



⇒ „1.1 Assembly overview - front exhaust pipe with catalytic converters“, page 145

⇒ „1.2 Assembly overview - front exhaust pipe with particulate filter“, page 146

⇒ „1.3 Removing and installing particulate filter“, page 147

⇒ „1.4 Assembly overview - exhaust manifold (engine codes BPD, BPE)“, page 148

⇒ „1.5 Removing and installing exhaust manifold (engine codes BPD, BPE)“, page 150

⇒ „1.6 Silencer with mountings“, page 153

1.1 Assembly overview - front exhaust pipe with catalytic converters

1 - From turbocharger

2 - Gasket

☐ Renew.

3 - Connecting clamp, 8 Nm

☐ Note installation position.

☐ Renew.

4 - Front exhaust pipe with starter catalytic converter

5 - Bracket

☐ Bolted to gearbox.

6 - 25 Nm

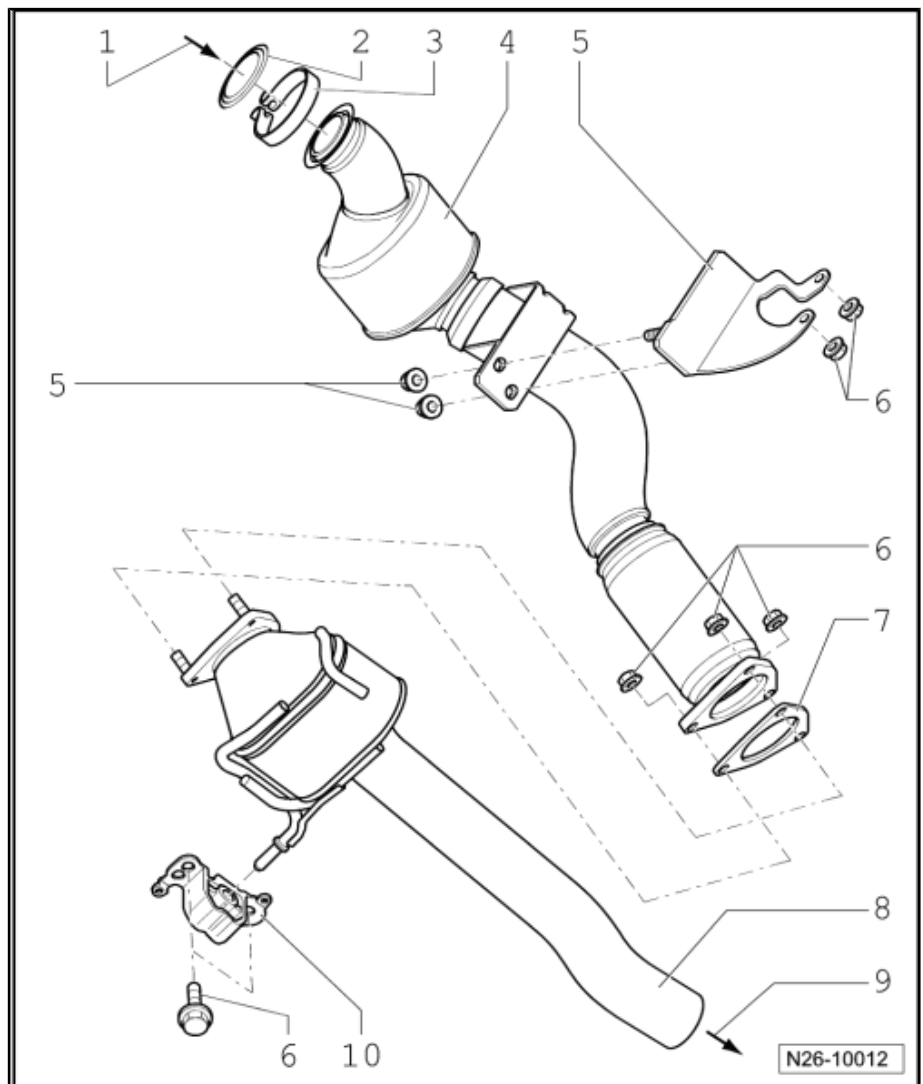
7 - Gasket

☐ Renew.

8 - Front exhaust pipe with catalytic converter

9 - To rear silencer

10 - Mounting





1.2 Assembly overview - front exhaust pipe with particulate filter



Note

If the particulate filter or the exhaust gas pressure sensor 1 - G450- is changed, the exhaust gas pressure sensor 1 -G450- must always be adapted using diagnosis tester : Guided functions; adapting exhaust pressure sensor 1 -G450- .

1 - Turbocharger

2 - Gasket

- ☐ Renew.
- ☐ Note installation position.

3 - Clamp, 7 Nm

- ☐ Renew.

4 - Exhaust gas pressure sensor 1 -G450-

- ☐ Guided functions; Adapting exhaust gas pressure sensor 1 - G450- .

5 - Bracket

- ☐ For control line

6 - 10 Nm

7 - Control line, 45 Nm

8 - Temperature sender after particulate filter -G527- , 45 Nm

- ☐ Lubricate thread of sender using high-temperature paste -G 052 112 A3-

9 - 25 Nm

10 - Rear support

11 - 40 Nm

12 - Particulate filter

- ☐ Guided functions; Adapting exhaust gas pressure sensor 1 - G450- .

- ☐ Removing and installing ⇒ [page 147](#)

13 - Front exhaust pipe

14 - Mounting

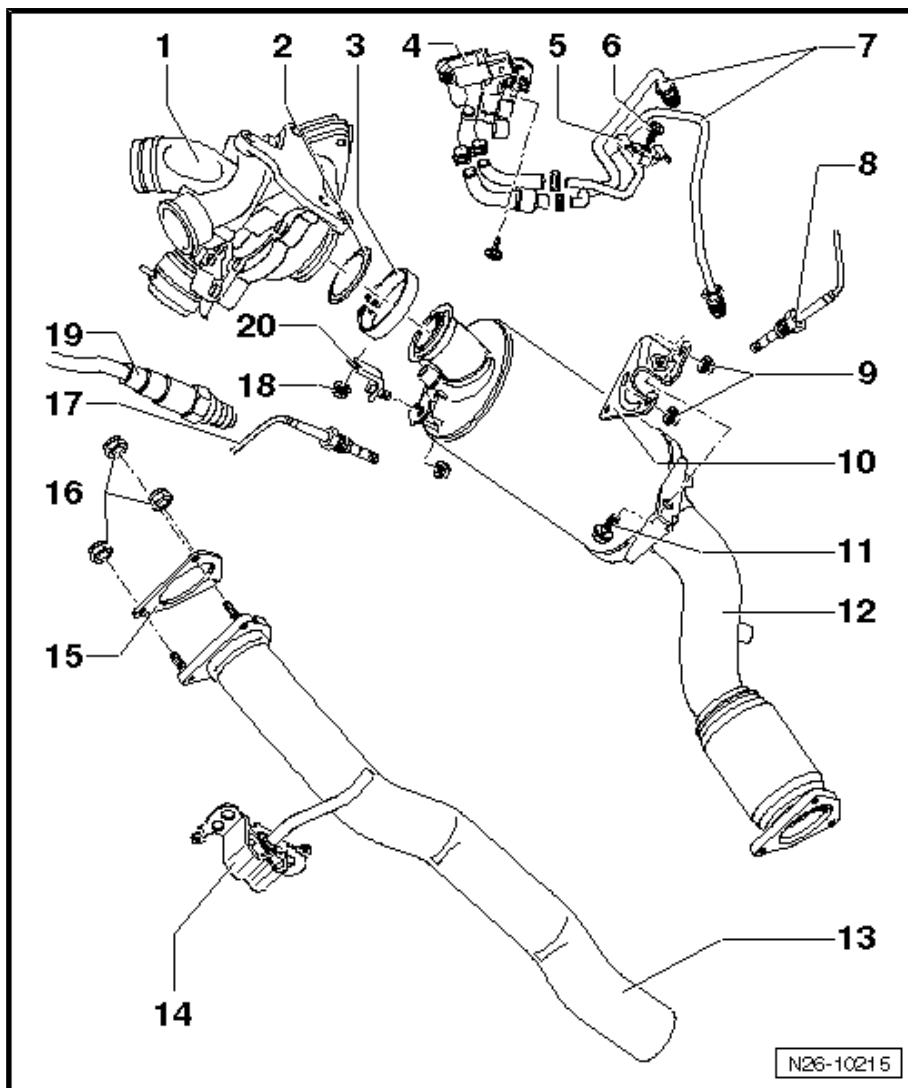
15 - Gasket

- ☐ Renew.

16 - 25 Nm

17 - Exhaust gas temperature sender 2 for bank 1 -G448-

- ☐ 45 Nm





- ❑ Lubricate thread of sender using high-temperature paste -G 052 112 A3-

18 - 40 Nm

19 - Lambda probe -G39-

- ❑ Grease only threads with high-temperature paste -G 052 112 A3- ; high-temperature paste -G 052 112 A3- must not get into the slots of probe body.

20 - Front support

1.3 Removing and installing particulate filter



Note

If the particulate filter or the exhaust gas pressure sensor 1 -G450- is changed, the exhaust gas pressure sensor 1 -G450- must always be adapted using diagnosis tester : Guided functions; adapting exhaust pressure sensor 1 -G450- .

Removing

- Loosen cooler for exhaust gas recirculation and remove bracket.
- Separate connectors to Lambda probe -G39- , to bank 1 exhaust gas temperature sender 2 -G448- , exhaust gas temperature sender 1 -G235- and temperature sender after particulate filter -G527- .

Separate cable ties.

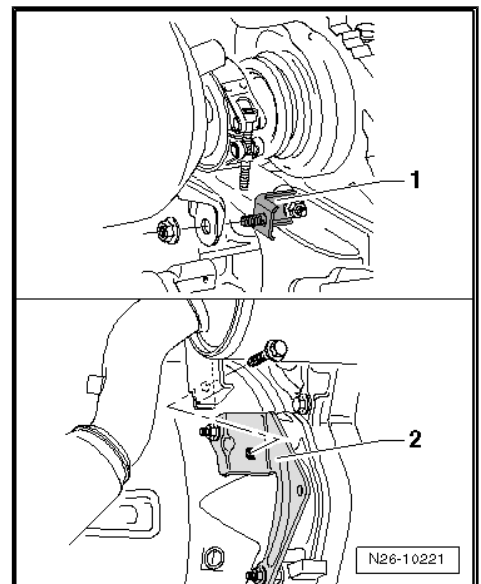
- Unscrew exhaust gas pressure sensor 1 -G450- from bracket.

The exhaust gas pressure sensor 1 -G450- and the control lines remain connected on the particulate filter.

- Remove front exhaust pipe.
- Loosen clamp.
- Remove front support -1- and rear support -2- from particulate filter.
- Take particulate filter out upwards.

Installing

- Insert particulate filter.





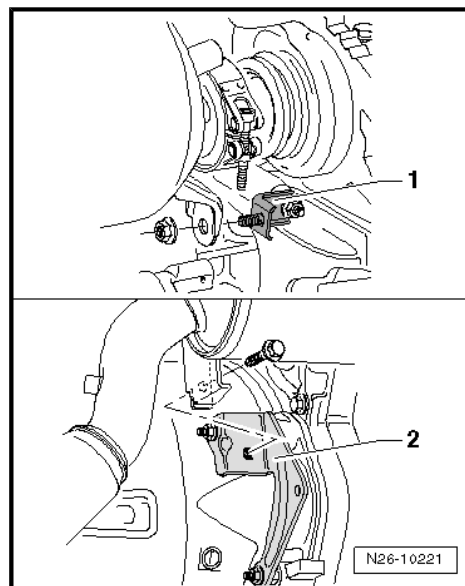
- Tighten rear support -2- on gearbox.
- Tighten hexagon nut of front support hand-tight.
- Fit clamp and new seal on particulate filter.
- Fit particulate filter to turbocharger and, simultaneously, tighten hexagon nut hand-tight.
- Align particulate filter and tighten bolt of clamp to 7 Nm.
- Tighten hexagon bolt.

Specified torque: 40 Nm.

- Tighten hexagon nut on thread of front support -1- and tighten hexagon nut on engine support.

Specified torque: 40 Nm

- Join connectors to Lambda probe -G39- , to bank 1 exhaust gas temperature sender 2 -G448- , exhaust gas temperature sender 1 -G235- and temperature sender after particulate filter -G527- and connect lines at the marked points using cable ties.
- Install front exhaust pipe.



1.4 Assembly overview - exhaust manifold (engine codes BPD, BPE)

⇒ [page 110](#) .



Note

- ◆ All hose connections are secured with clamps or retaining clips.
- ◆ Renew self-locking nuts.

1 - Bracket

2 - Exhaust gas recirculation cooler

- ☐ Removing and installing
⇒ [page 157](#).

3 - Gasket

- ☐ Renew.

4 - Exhaust gas temperature sender 1 -G235-

- ☐ 45 Nm
- ☐ Lubricate thread of sender using high-temperature paste -G 052 112 A3-

5 - 40 Nm + 90° turn

- ☐ Renew.
- ☐ Qty. 3
- ☐ Do not grease

6 - Washers

- ☐ Qty. 3

7 - Gasket

- ☐ Renew.
- ☐ Note installation position.

8 - Exhaust manifold

- ☐ To remove: remove exhaust gas recirculation cooler and remove securing bolts securing turbocharger to exhaust manifold
⇒ [Item 5 \(page 149\)](#).

9 - 25 Nm

- ☐ Renew.

10 - Flange upper part

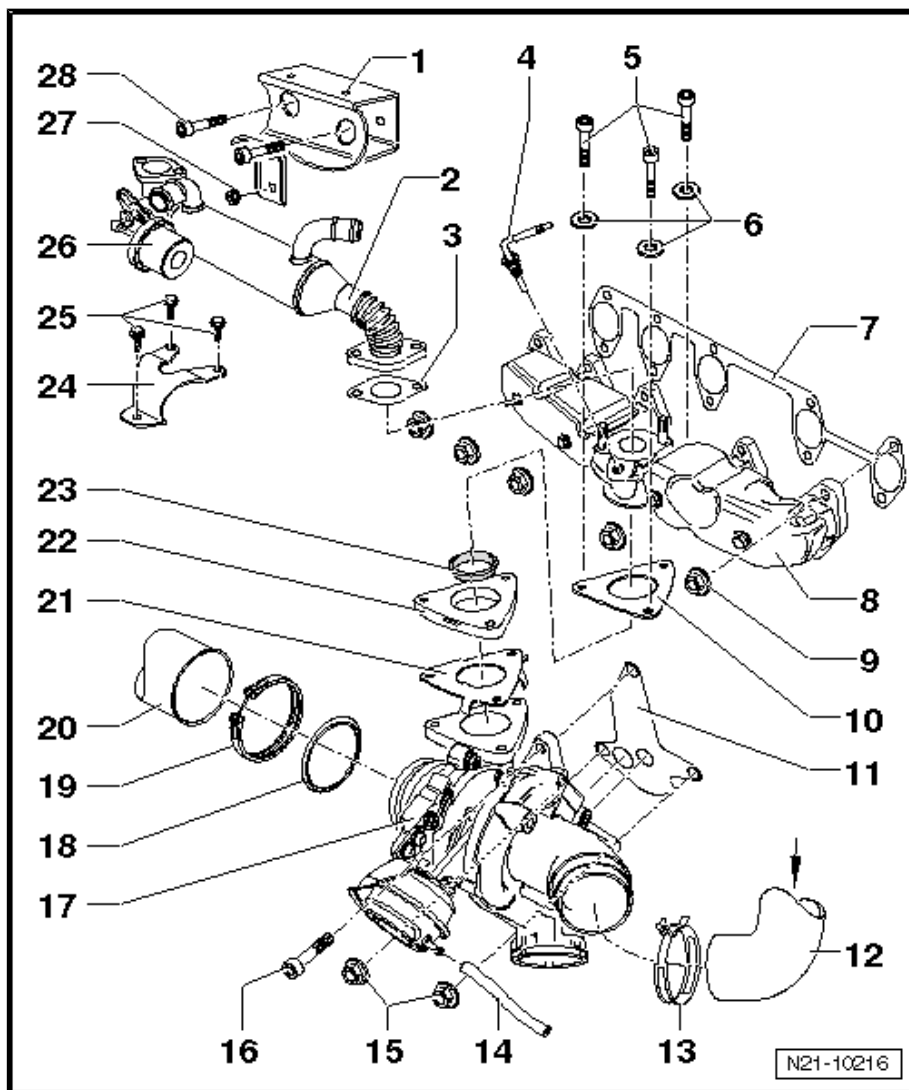
- ☐ Renew.

11 - Seal

- ☐ Renew.

12 - Connecting hose

- ☐ From air filter.



Volkswagen Technical Site: <http://vwts.ru> <http://vwts.info>



13 - Clip

14 - Vacuum line

15 - 40 Nm + 90° turn

16 - 40 Nm + 90° turn

17 - Turbocharger

- ☐ Removing and installing ⇒ [page 116](#)

18 - Gasket

- ☐ Renew.
- ☐ Note installation position.

19 - Clamp, 7 Nm

- ☐ Renew.

20 - Particulate filter

21 - Gasket

- ☐ Renew.
- ☐ Note installation position.

22 - Flange lower part

- ☐ Renew.

23 - Gasket

- ☐ Renew.
- ☐ Note installation position.

24 - Bracket upper part

25 - 10 Nm

26 - Vacuum actuator

- ☐ For bypass flap.
- ☐ Renew only together with exhaust gas recirculation cooler

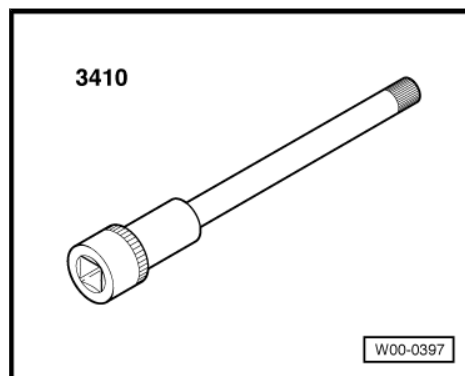
27 - 10 Nm

28 - 15 Nm

1.5 Removing and installing exhaust manifold (engine codes BPD, BPE)

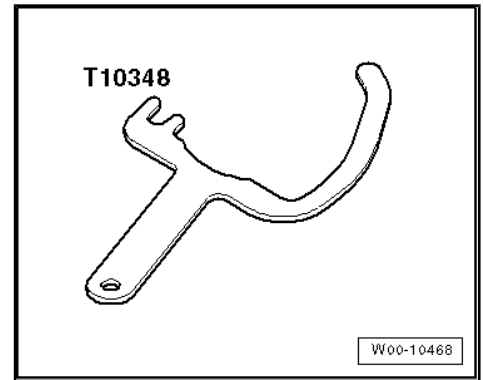
Special tools and workshop equipment required

- ◆ Allen key, long reach -VAS 3410-

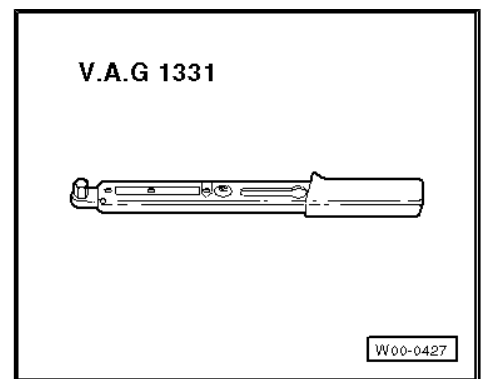




◆ Gauge -10348-



◆ Torque wrench -V.A.G 1331/-



Removing exhaust manifold (engine codes BPD, BPE)

- Remove exhaust gas recirculation cooler ⇒ [page 157](#) .
- Removing bracket ⇒ [Item 1 \(page 149\)](#) .
- Remove exhaust temperature sender 1 -G235-
⇒ [Item 4 \(page 149\)](#) .
- Unscrew exhaust manifold securing nut ⇒ [Item 9 \(page 149\)](#) .
- Unscrew bolts to turbocharger ⇒ [Item 5 \(page 149\)](#) .
- Remove exhaust manifold.

Installing exhaust manifold (engine codes BPD, BPE)

- Renew all seals and gaskets.
- Specified torque ⇒ [page 148](#) .
- Install in reverse order.
- In the process, note the following:
- ◆ In the case of a used exhaust manifold:
 - Clean exhaust manifold connection using abrasive paper.



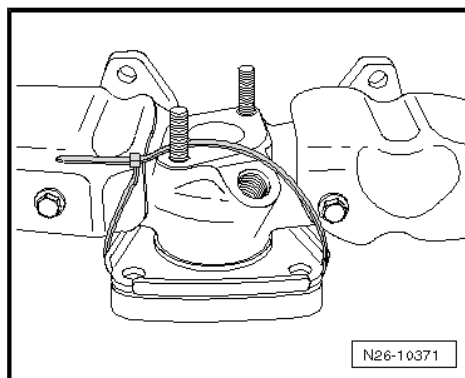
Note

The abrasive paper grade must not be less than 100.

- Fit new gasket onto turbocharger ⇒ [Item 23 \(page 116\)](#) .
- Fit sealing set onto exhaust manifold.
- The sealing set consists of:
 - ◆ Flange upper part ⇒ [Item 10 \(page 115\)](#)
 - ◆ Gasket ⇒ [Item 23 \(page 150\)](#)

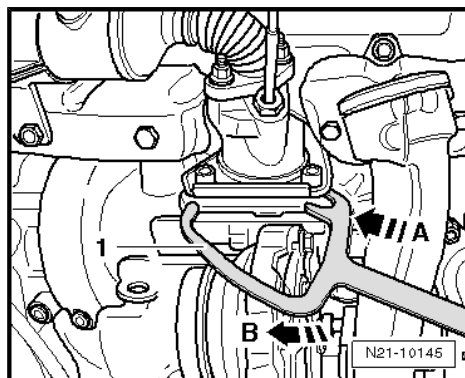


- ◆ Flange lower part ⇒ [Item 22 \(page 116\)](#)
- Fix a new sealing set to exhaust manifold, e.g. using cable ties.
- Install exhaust manifold with sealing set on cylinder head
⇒ [Item 8 \(page 149\)](#).
- Remove cable tie from sealing set.
- Start bolts on turbocharger. ⇒ [Item 5 \(page 149\)](#)

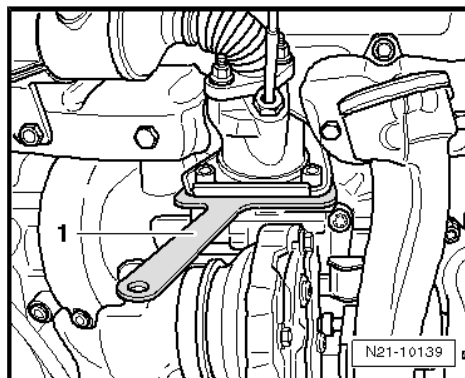


- Insert gauge -T10348- -1- in direction of arrow -A- and turn gauge -T10348- in direction of arrow -B-.

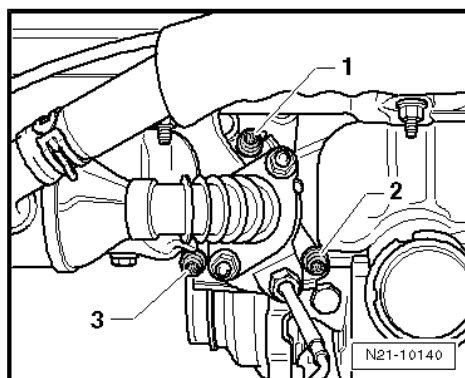
1



- Gauge -T10348- must be located between flange upper and flange lower parts.



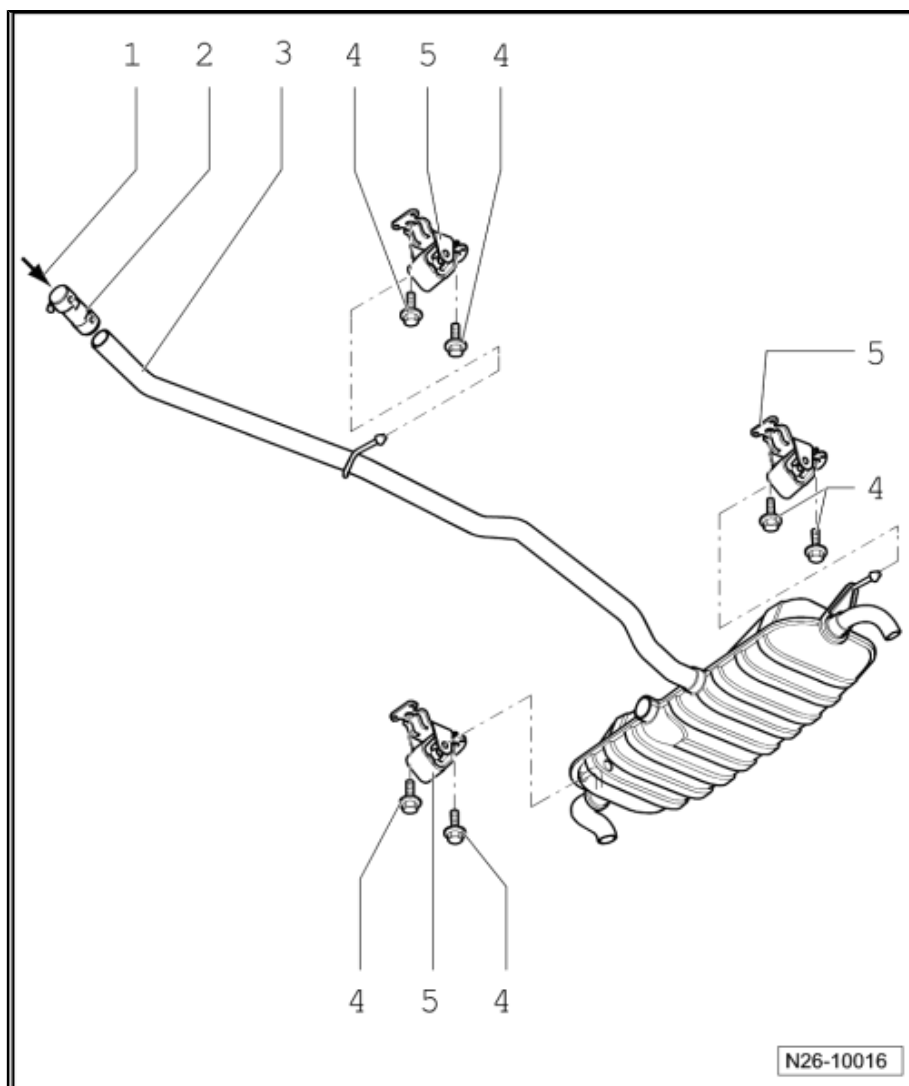
- Tighten bolts -1-, -2- and -3- to 5 Nm.
- Loosen bolts by turning 180°.
- Remove gauge from turbocharger.
- Tighten bolts one by one to 30 Nm in 90° steps.
- Then turn all bolts 180° further.





1.6 Silencer with mountings

- 1 - From front exhaust pipe
- 2 - Double clamp
- 3 - Exhaust pipe with rear si-lencer
- 4 - 25 Nm
- 5 - Mounting





2 Exhaust gas recirculation system

⇒ „2.1 Assembly overview - exhaust gas recirculation“,
page 155

⇒ „2.2 Checking exhaust gas recirculation valve (mechanical)“,
page 158



Note

- ◆ *The exhaust gas recirculation system is actuated by the engine control unit via the exhaust gas recirculation valve -N18- (electropneumatic) to the exhaust gas recirculation valve (mechanical).*
- ◆ *The cone-shaped plunger in the mechanical exhaust gas recirculation valve ensures that various opening cross-sections are possible at different valve lifts.*
- ◆ *Renew self-locking nuts.*



2.1 Assembly overview - exhaust gas recirculation

⇒ „2.1.1 Assembly overview - exhaust gas recirculation (engine codes BAC and BLK)“, page 155

⇒ „2.1.2 Assembly overview - exhaust gas recirculation, intake manifold side (engine codes BPD and BPE)“, page 156

⇒ „2.1.3 Assembly overview - exhaust gas recirculation, exhaust gas side (engine codes BPD and BPE)“, page 157

⇒ „2.1.4 Removing and installing exhaust gas recirculation cooler (engine codes BPD and BPE)“, page 157

2.1.1 Assembly overview - exhaust gas recirculation (engine codes BAC and BLK)

1 - 10 Nm

2 - From charge air cooler

3 - Intake connecting pipe

- ☐ With mechanical exhaust gas recirculation valve and intake manifold flap
- ☐ Can only be renewed in its entirety, together with exhaust gas recirculation valve and intake manifold flap.
- ☐ Perform mechanical inspection of exhaust gas recirculation valve
⇒ [page 158](#).

4 - O-ring

- ☐ Renew.

5 - Intake manifold

6 - Coolant hose

- ☐ Coolant hose schematic diagram

7 - 10 Nm

8 - Exhaust gas recirculation cooler

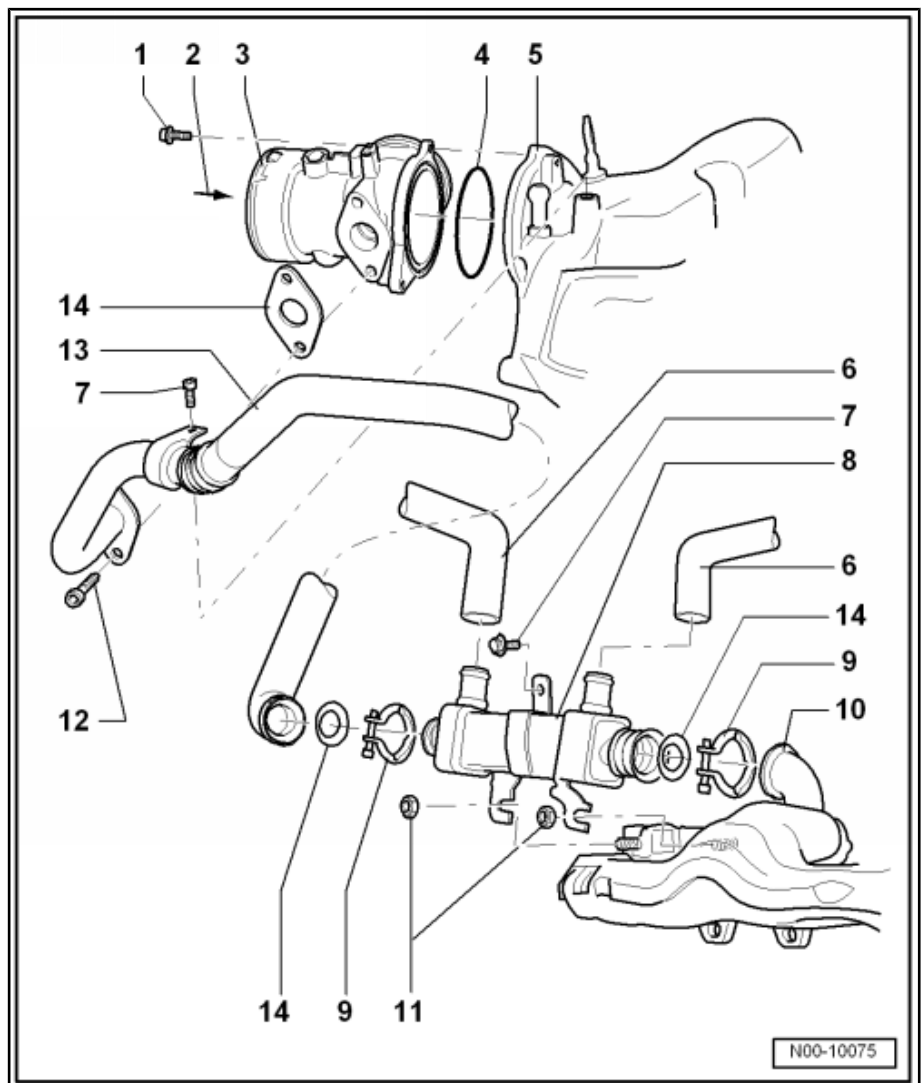
- ☐ Vehicles with automatic gearbox and exhaust gas recirculation changeover valve.
- ☐ Coolant hose schematic diagram

9 - Connecting clamp, 8 Nm

10 - Exhaust manifold

11 - 25 Nm

- ☐ Renew.





12 - 25 Nm

13 - Connecting pipe

14 - Gasket

- ☐ Renew.

2.1.2 Assembly overview - exhaust gas recirculation, intake manifold side (engine codes BPD and BPE)

1 - 10 Nm

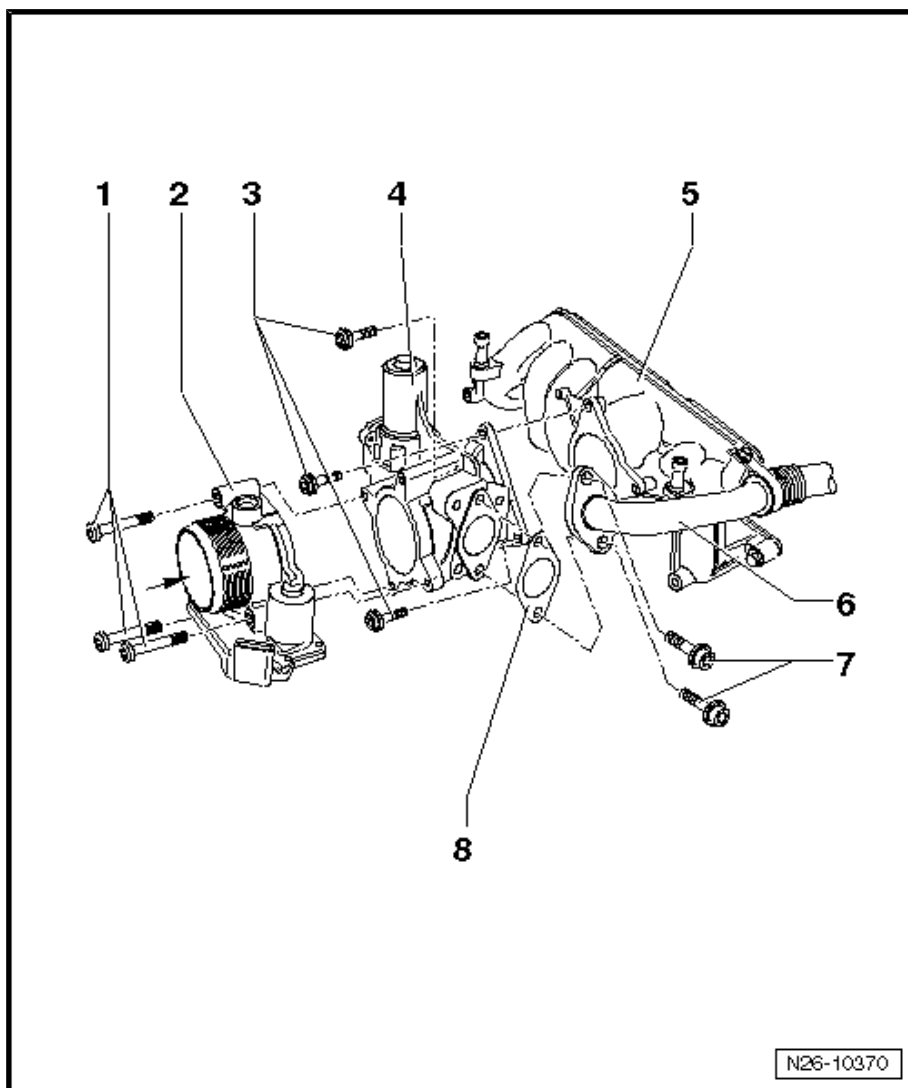
2 - Intake manifold flap motor - V157-

- ☐ The intake manifold flap is closed for approx. 3 seconds when stopping engine and then opens again. This reduces the stop jolt.

3 - 10 Nm

4 - Exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer - G212-

- ☐ Before installing, check sealing surface on intake manifold for soiling and clean if necessary
- ☐ If the exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer - G212- is renewed the ignition must be switched on and off again. Then wait one minute for the control unit to run down (valve learns, main relay must click)
- ☐ Start engine and run at idling speed for one minute.
- ☐ Then read engine control unit event memory; event memory must not contain any fault
⇒ [page 139](#) .



5 - Intake manifold

6 - Connecting pipe

- ☐ To exhaust gas recirculation cooler.

7 - 22 Nm

8 - Gasket

- ☐ Renew.



2.1.3 Assembly overview - exhaust gas recirculation, exhaust gas side (engine codes BPD and BPE)

1 - 8 Nm

2 - Bracket upper part

3 - Bracket

4 - 15 Nm

5 - 8 Nm

6 - Coolant hoses

- ☐ To remove: clamp off exhaust gas recirculation cooler using hose clamps, up to 25 mm -3094- .

7 - 25 Nm

8 - Gasket

- ☐ Renew.

9 - Exhaust gas temperature sender 1 -G235-

- ☐ 45 Nm
- ☐ Lubricate thread of sender using high-temperature paste -G 052 112 A3-

10 - Exhaust manifold

11 - Exhaust gas recirculation cooler changeover valve - N345-

12 - Connecting hose

13 - 10 Nm

14 - Vacuum actuator

- ☐ For bypass flap.
- ☐ Renew only together with exhaust gas recirculation cooler

15 - Exhaust gas recirculation cooler

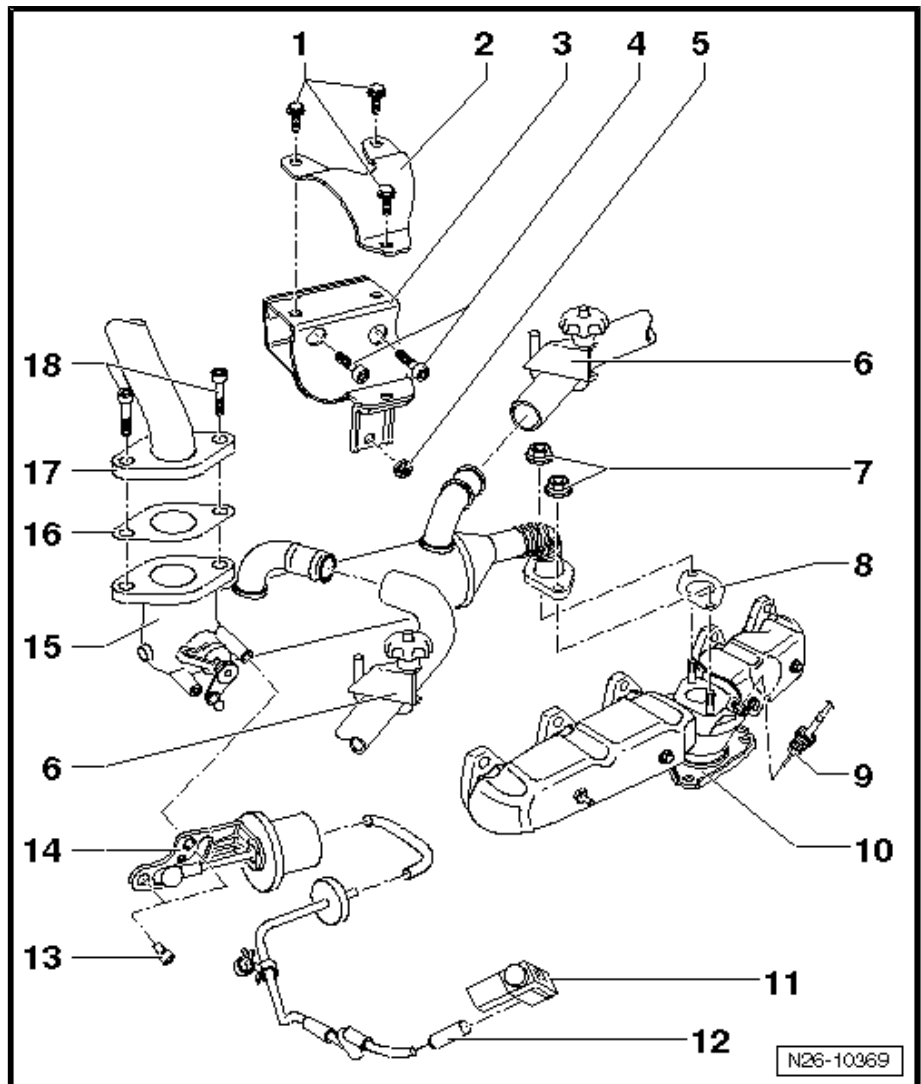
16 - Gasket

- ☐ Renew.

17 - Connecting pipe

18 - 22 Nm

19 - 10 Nm

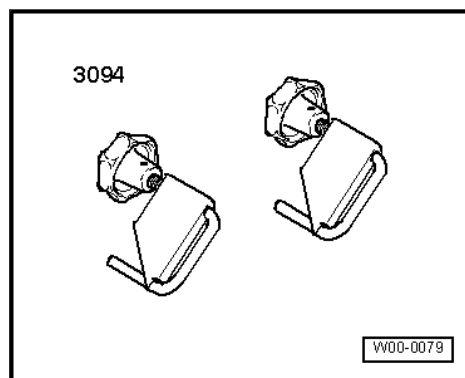


2.1.4 Removing and installing exhaust gas recirculation cooler (engine codes BPD and BPE)

Special tools and workshop equipment required



- ◆ Hose clamps up to 25 mm -3094-



Removing

- Remove connecting pipe ➔ [Item 17 \(page 157\)](#) .
- Disconnect and remove coolant hoses ➔ [Item 6 \(page 157\)](#) .
- Use a cloth to collect residual coolant.
- Disconnect connecting hose from vacuum unit ➔ [Item 14 \(page 157\)](#) .
- Remove upper part bracket ➔ [Item 2 \(page 157\)](#) .
- Unbolt connection to exhaust manifold ➔ [Item 7 \(page 157\)](#) .
- Carefully remove exhaust gas recirculation cooler. Dispose of residual coolant.

Installing

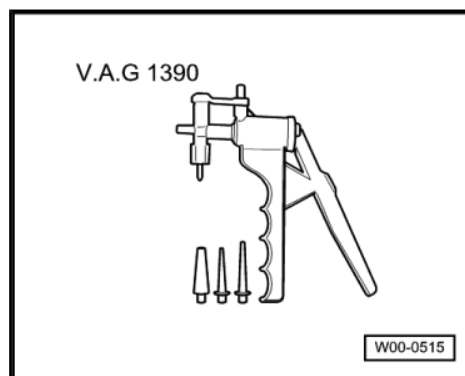
- Install in reverse order.
- Specified torque ➔ [page 157](#) .
- Replenish coolant ➔ [page 74](#) .

2.2 Checking exhaust gas recirculation valve (mechanical)

Only for engine codes BAC and BLK

Special tools and workshop equipment required

- ◆ Hand vacuum pump -V.A.G 1390-



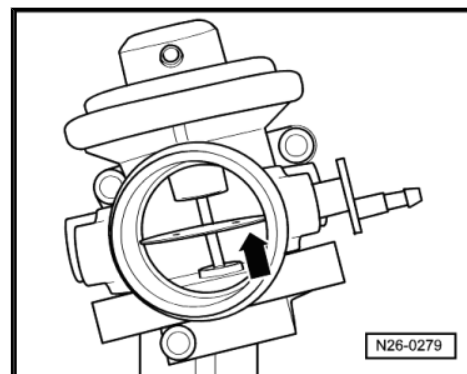
Vacuum hose schematic diagram for engine codes BAC and BLK
➔ [page 125](#)

Test procedure

- Remove charge air pipe / intake connecting pipe connecting hose.
- Disconnect vacuum hose from mechanical exhaust gas recirculation valve.



- Connect hand vacuum pump -V.A.G 1390- to valve.
- Operate hand vacuum pump -V.A.G 1390- and observe diaphragm rod.
- The diaphragm rod must move in -direction of arrow-.
- Remove hose of hand vacuum pump -V.A.G 1390- from mechanical exhaust gas recirculation valve.
- The diaphragm rod must move back to its original position counter to the direction of the arrow





28 – Glow plug system

1 Glow plug system

⇒ „1.1 Characteristics of glow plugs“, page 160

⇒ „1.2 Checking metal glow plugs“, page 160 .

⇒ „1.3 Removing, installing and checking ceramic glow pin plugs“, page 162 .

1.1 Characteristics of glow plugs



Caution

Ceramic glow plugs are sensitive to knocks and bending.

For this reason a glow plug which has dropped from even a small height (approx. 2 cm) must not be used, even if there is no obvious damage.

It is absolutely essential to follow the installation instructions, otherwise the heater pin of the glow plug can break and cause engine damage.

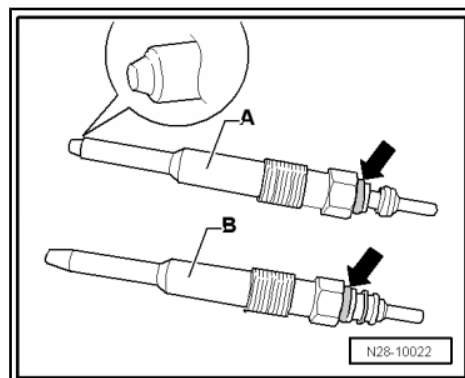
Optical characteristics of glow plugs

A - Ceramic glow plugs, phase step on top (see enlargement), colour-coded white -arrow-.

B - Metal glow plugs, colour-coded green -arrow-.

Removing, installing and checking ceramic glow plugs
⇒ [page 162](#) .

Checking metal glow plugs ⇒ [page 160](#) .



1.2 Checking metal glow plugs

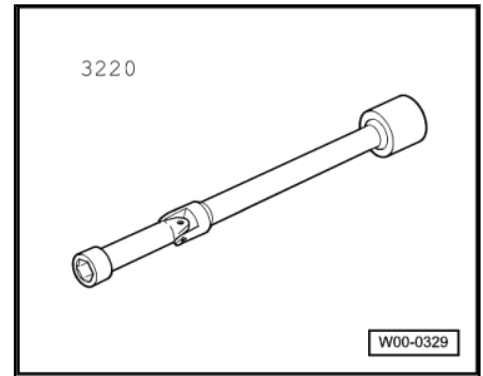
Special tools and workshop equipment required

- ♦ Auxiliary measuring set -V.A.G 1594C-

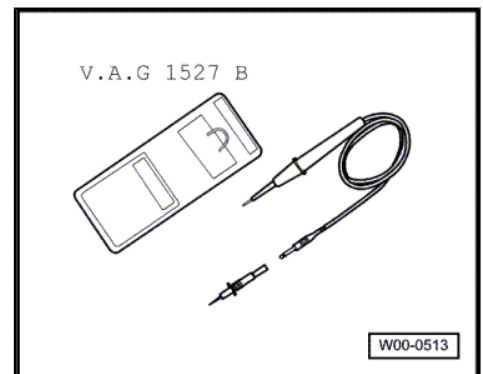




- ◆ 10 mm jointed spanner -3220-



- ◆ Voltage tester -V.A.G 1527B-



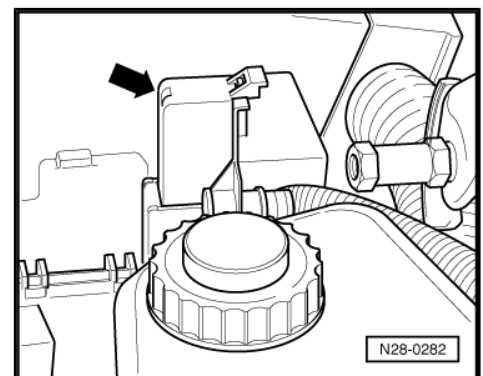
Test prerequisites

- Battery voltage at least 11.5 V
- Ignition switched off

Test procedure

- Remove intake manifold ⇒ [page 135](#) .
- Pull glow plug connectors off glow plugs.
- Connect voltage tester line to battery positive terminal using auxiliary clamps from auxiliary measuring set -V.A.G 1594C- .
- Place test probe of voltage tester on each glow plug one after the other. Diode lights up: glow plug OK., diode does not light up: renew glow plug.
- Remove and install glow plugs with U/J extension and socket, 10 mm -3220- .

Specified torque: 15 Nm

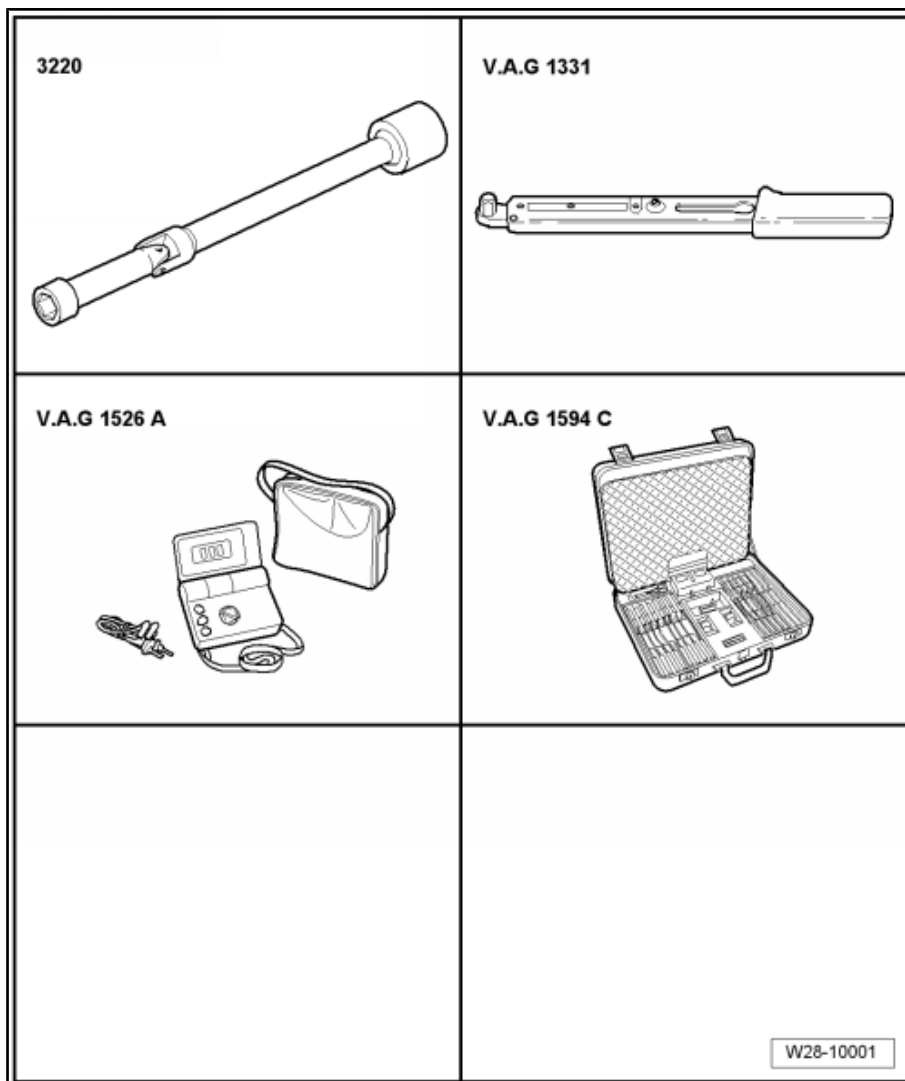




1.3 Removing, installing and checking ceramic glow pin plugs

Special tools and workshop equipment required

- ◆ 10 mm jointed spanner -3220-
- ◆ Torque wrench -V.A.G 1331-
- ◆ Hand-held multimeter - V.A.G 1526A-
- ◆ Auxiliary measuring set - V.A.G 1594C-



Not illustrated:

- ◆ Flat-headed pliers -VAS 6275-



Caution

Ceramic glow plugs are sensitive to knocks and bending.

For this reason a glow plug which has dropped from even a small height (approx. 2 cm) must not be used, even if there is no obvious damage.

It is absolutely essential to follow the installation instructions, otherwise the heater pin of the glow plug can break and cause engine damage.

Test prerequisites

- ◆ Engine is cold
- ◆ Ignition switched off



Procedure



Note

*Do not cant ceramic glow plugs when removing and installing.
Remove any components hindering assembly.*

- Remove intake manifold ⇒ [page 135](#) .
- Pull connectors off ceramic glow plugs using flat headed pliers -VAS 6275- .
- Remove ceramic glow plugs using U/J extension and socket, 10 mm -3220- .

Installation is carried out in the reverse order; note the following:

- Before installing, bore in cylinder head and threads must be completely cleaned of all deposits.



Note

Do not oil or grease thread of cylinder head bore or of ceramic glow pin plugs.

- Turn ceramic glow plugs into cylinder head by hand using U/J extension and socket, 10 mm -3220- .
- Then tighten the ceramic glow plugs.

Specified torque:

- WAF 8 = 12 Nm
- WAF 10 = 15 Nm



Caution

After installing and before the engine is started, perform a resistance test on all ceramic glow plugs when engine is cold.

- *Specification: max. 1.0 Ω*

- If the specification is exceeded, renew the defective ceramic glow plug.



Note

If the defective ceramic glow plug is broken, remove all fragments from the engine, otherwise these can cause damage to the engine.